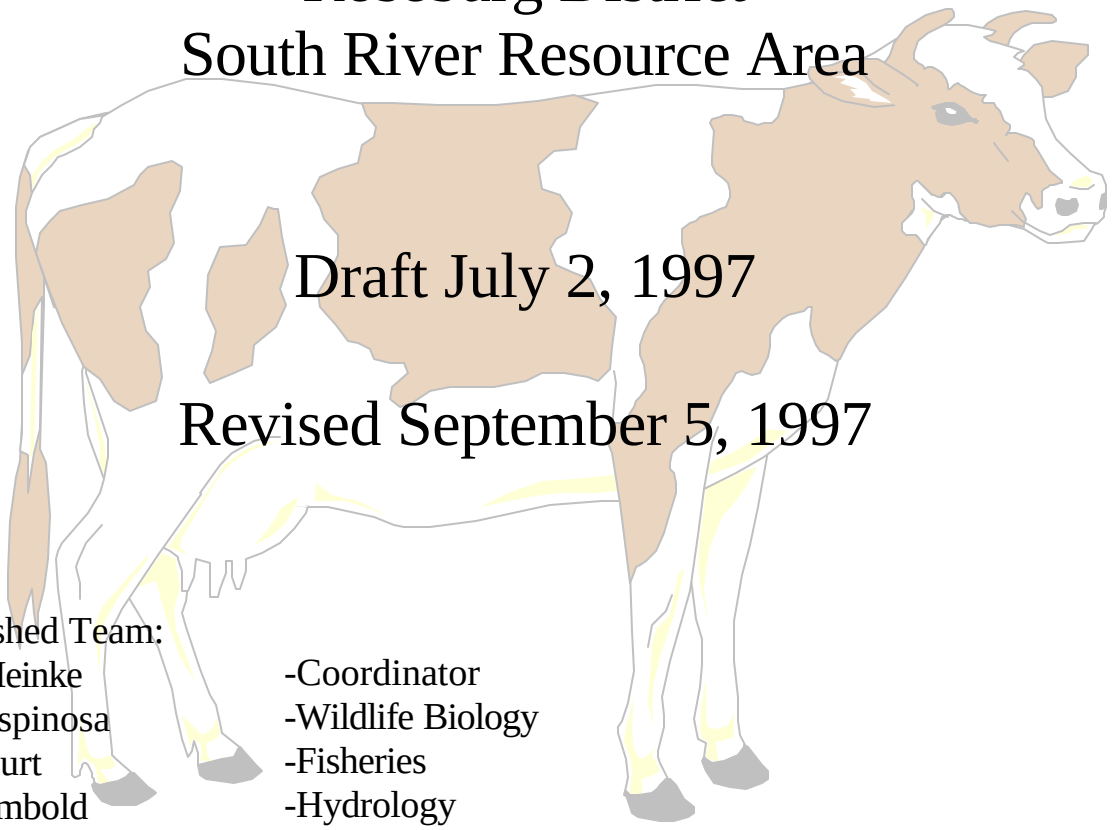
Cow Creek Watershed Analysis

Roseburg District
South River Resource Area



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Cow Creek WAU

Characterization

The Cow Creek WAU covers approximately 118,340 acres with the Bureau of Land Management (BLM) administering approximately 42,447 acres (36%) within the WAU. Bureau of Land Management administered lands are composed of Matrix, Late-Successional Reserve (LSR), and Riparian Reserve Land Use Allocations. Approximately 7,166 acres (17%) of BLM administered lands that are available for intensive forest management. This would be about 6% of the WAU.

Approximately 700 acres per decade are expected to be harvested on BLM administered lands within the Cow Creek WAU. This would be about ten percent of the 7,166 acres considered available for harvesting within the WAU. Although, less than two percent of the Cow Creek WAU would be harvested per decade.

Middle Creek was designated a Tier 1 Key Watershed. Key watersheds are a high priority for watershed restoration. Acid mine drainage from the Silver Butte Mine made Middle Creek uninhabitable for aquatic species. Restoration activities have occurred to keep the acid drainage from flowing into Middle Creek.

Timber harvesting, agriculture, mining, and recreation have been the dominant human uses in the Cow Creek WAU. The towns of Riddle and Tri City lie within the WAU.

The watershed analysis uses the format presented in the Ecosystem Analysis at the Watershed Scale, Federal Guide for Watershed Analysis. The Key Issues, Findings, and Recommendations and Restoration Opportunities are presented below and in Table ES-1.

Key Issues

The following issues and concerns were identified during the analysis.

•Management of the Late-Successional Reserve portion in the Cow Creek WAU.

•Risk reduction activities.

•Vegetation condition in the Riparian Reserves.

•Water quality.

•Impacts to Middle Creek from mining.

•The impacts roads have on streams due to sediment.

•The impact harvest areas have on peak flows in streams, especially in the transient snow zone, and the effect of introducing sediment into streams.

•The amount of timber harvesting in the past 30 years on BLM administered lands and fragmentation of suitable owl habitat.

Findings

Vegetation

•Sixty-one percent of BLM Administered Land in the WAU is within the LSR. Seventeen percent of the BLM Administered Land in the WAU is available for timber harvesting.

•Timber harvesting on BLM Administered Land would affect less than 2% (700 acres out of 118,340 acres) of the WAU per decade.

•Port-Orford Cedar is known to occur in 14 sections within the Cow Creek WAU. Five sections contain trees infected with Phytophthora lateralis.

Hydrology and Fisheries

•Main concerns are sediment in streams and water quality. High road densities, high stream crossing densities, and cumulative effects of harvesting in the past 30 years especially within the transient snow zone have probably increased peak flows and increased sediment in the streams.

•Current water quality concerns are high temperatures, low dissolved oxygen levels, and pH levels that do not meet state water quality standards.

•Most of the Aquatic Habitat Inventory stream reaches surveyed were rated as fair. The majority of stream reaches rated as poor were in the Upper and Lower Middle Creek subwatersheds.

Northern Spotted Owl

•There are 22,328 acres of BLM Administered Land in the Cow Creek WAU considered to be suitable spotted owl habitat.

•There are 63 spotted owl sites within the WAU. Forty-nine spotted owl sites are on BLM Administered Land. Fifteen sites on BLM Administered Land were active sites in 1996. Twelve spotted owl sites on BLM administered lands are protected with 100 acre activity centers (core areas).

•Five quarter townships currently have less than 50% in spotted owl dispersal habitat.

Peregrine Falcon

•Some potential recreation opportunities may conflict with management for the Peregrine Falcon.

Elk

•There are portions of three Elk Management Areas identified in the PRMP and the RMP within the Cow Creek WAU.

•Management activities to improve elk habitat may support or conflict with LSR objectives.

Recommendations and Restoration Opportunities

Vegetation

•Consider protecting Port-Orford Cedar by density management or sanitation harvesting along roads. Two areas to consider are T31S R7W Section 1 and T30S R8W Section 25.

•Consider studying whether to designate T30S, R6W, Section 19 as a Research Natural Area (RNA). Consider closing roads in T30S, R6W, Section 19 to protect Port-Orford Cedar from being infected by Phytophthora lateralis and to protect Port-Orford Cedar in the Beatty Creek RNA from being infected.

•Salvaging within the LSR should be conducted if it is essential to reduce the risk of future stand replacing fires or insect damage.

•Treatments, such as density management or hardwood conversion, to restore large conifers to Riparian Reserves should be considered in the Upper and Lower Middle Creek subwatersheds.

Soils

•Management activities on granitic soils should follow or adhere to Best Management Practices. On-site investigation by a soil scientist is recommended for any ground disturbing activity on granitic soils.

•Existing native forest vegetation is best suited for serpentine soils. Stand conversion to other commercial forest types should only be attempted if hard data exists to justify a forest type change.

•Best Management Practices (BMPs) should be applied during all ground and vegetation disturbing activities. Along with the BMPs, the Standards and Guidelines brought forth from the Record of Decision (USDA and USDI 1994) should be implemented in order to achieve proper soil management. Best Management Practices should be monitored for implementation and effectiveness in order to document if soil goals are being achieved.

Hydrology

•Continue Proper Functioning Condition Assessments.

•Identify road decommissioning and culvert replacement opportunities. Roads in Buck Martin, Iron Mountain, Upper Union, Dutchman Creek, Panther Peavine, and Upper Middle Creek should be considered for decommissioning.

•Measure summer base flows (at the stream temperature monitoring sites) to determine which streams store groundwater and release it as surface flow during the dry summer season. Iron Mountain, Union, Middle, and Cattle creeks are currently being monitored for stream temperature.

•Water quality parameters should continue to be monitored in the Lower and Upper Middle Creek subwatersheds, especially at the Silver Butte mining site to assess recovery. Water quality restoration should continue in Middle Creek.

•Riparian areas along fish bearing streams dominated by alders should be considered for conversion to conifers in order to provide a future source of large woody debris. Girdling the alders and underplanting conifers would not negatively impact current streamside shade or the sediment regime.

•Density management should be considered in the Lower and Upper Middle Creek subwatersheds to improve and enhance riparian characteristics, by accelerating tree growth for future streamside shade. Placing large woody debris in Middle Creek should be considered to create habitat diversity and reduce localized erosion.

•Monitor suspended sediment, turbidity, and streamflow near mouth of Iron Mountain Creek.

Fisheries

•The priority for fisheries restoration in this WAU would be removing man-made barriers to fish passage (i.e. culverts) and replacing them with structures that provide fish passage (i.e. bridges or bottomless arch pipes).

•Consider monitoring for fish use in Middle Creek, upstream from the confluence with the South Fork of Middle Creek .

•Upper Middle Creek and Lower Middle Creek subwatersheds would benefit from stream and riparian restoration. Areas to consider first for restoration activities include Martin Creek, Peavine Creek, Iron Mountain Creek, Union Creek, and Upper Middle Creek.

•The two existing instream project sites on Martin Creek should be monitored and maintained.

•Consider continuing coho spawning surveys in the mainstem of Middle Creek and Martin Creek. Additional spawning survey reaches in tributaries of Middle Creek should be considered. Areas to consider include the tributary to Martin Creek located in $SW^1/_4$, $SE^1/_4$, of section 1, in T32S, R7W, Buck Creek, Smith Creek, and Hare Creek.

•Reclamation and restoration work should continue in the mainstem of Middle Creek to mitigate the adverse impacts of acid drainage from the Silver Butte mine. The project area should be monitored following winter streamflows. Instream project work in Middle Creek should be maintained.

Wildlife

Northern Spotted Owl

•Determine location of harvest areas to minimize fragmentation based on criteria developed using spotted owl data and table.

•Projects that reduce dispersal habitat should be avoided until quarter townships have more than 50 percent dispersal habitat.

•Projects that modify or remove suitable owl habitat should be planned in areas outside of known territories first. If this is not possible then modification or removal of suitable habitat in the Cow Creek WAU should follow the rankings in Table 26.

• Consider managing Spotted Owl Critical Habitat in the Cow Creek WAU to minimize fragmentation.

American Bald Eagle

•Consider maintaining bald eagle habitat characteristics, such as dominant old-growth trees, in stands within one mile and facing Cow Creek or the South Umpqua River.

•Consider conducting winter surveys along Cow Creek for bald eagles.

Peregrine Falcon

•Maintain integrity of peregrine falcon nesting sites and moderate to high potential sites.

Elk

•Consider developing goals for elk management areas overlapping the Cow Creek WAU.

Neotropical Birds

•Consider scheduling management activities, such as burning, brushing, PCT, commercial thinning, timber harvesting, and other activities that remove or modify neotropical bird habitat so they do not occur during the breeding season, between April 1 and July 30 of any given year.

Table ES-1. Cow Creek WAU Recommendations and Restoration Opportunities

CONCERN	DESIRED CONDITIONS	MANAGEMENT STRATEGIES, ACTIVITIES, AND RECOMMENDATIONS
VEGETATION		
Late-successional/Old-growth stands	Maintain, protect, and develop Late-successional/Old-growth stands in LSR and Riparian Reserves.	Density management, pruning, fertilization, or brush control in younger stands (less than 80 years old).
Risk reduction activities	Protect stands in LSR.	Density management or brush control in younger stands (less than 80 years old). Prescribed fire to reduce fuels, especially activity fuels.
Port-Orford Cedar	Maintain disease free stands of Port-Orford Cedar, eliminate the spread of Phytopthora lateralis as much as possible.	Follow Port-Orford Cedar Management Guidelines. Seasonal restrictions in areas with Port-Orford Cedar. Roadside sanitation of Port-Orford Cedar.
Vegetation conditions in Riparian Reserves	Large conifers providing shade and potential LWD.	Density management. Evaluate hardwood conversion.
Noxious Weeds	Participate in noxious weed management program with Oregon Department of Agriculture.	Continue to monitor known sites of yellow starthistle and Rush skeletonweed.
Survey and Manage Plants	Increase knowledge base.	Conduct surveys. Continue work on conservation strategy for Calochortus coxii.
SOILS		
Granitic and serpentine soils	Decrease the risk of impact on fragile soils.	Use caution when conducting activities on granitic soils. Use native forest vegetation to revegetate serpentine soils. Stand conversion on serpentine soils is not recommended. Apply BMPs to all ground and vegetation disturbing activities.

Table ES-1. Cow Creek WAU Recommendations and Restoration Opportunities

CONCERN	DESIRED CONDITIONS	MANAGEMENT STRATEGIES, ACTIVITIES, AND RECOMMENDATIONS
HYDROLOGY		
Water quality	Excessive sedimentation minimized, stream temperatures, dissolved oxygen, and pH meet state water quality standards.	Decommission, close, or improve roads. Continue water quality monitoring in Lower and Upper Middle Creek Subwatersheds. Evaluate roads for possible decommissioning in 6 drainages. Evaluate roads and/or culverts causing excessive erosion or other problems.
Restoration opportunities to benefit fish	Stream temperatures, dissolved oxygen, and pH meet state water quality standards.	Density management in Riparian Reserves, hardwood conversion, and/or place LWD in streams.
FISHERIES		
Fish passage	Provide for fish passage in streams that historically contained fish.	Consider removing man-made fish barriers and replace with structures allowing fish passage.
Restoration opportunities	Improved fish habitat.	Martin Creek, Peavine Creek, Iron Mountain Creek, Union Creek, and Upper Middle Creek are areas to consider for restoration opportunities. Density management in Riparian Reserves, hardwood conversion, and/or place LWD in streams.
WILDLIFE		
Northern Spotted Owl and Late-successional/old-growth forests	Restore late successional vegetation in known owl territories and Minimize fragmentation of late-successional/old-growth stands.	Follow go to rankings when deciding potential project areas.
Northern Spotted Owl dispersal and Critical Habitat	Maintain dispersal and critical habitat on the landscape.	Use dispersal habitat data and critical habitat objectives during project development.

Table ES-1. Cow Creek WAU Recommendations and Restoration Opportunities

CONCERN	DESIRED CONDITIONS	MANAGEMENT STRATEGIES, ACTIVITIES, AND RECOMMENDATIONS
Peregrine Falcon	Knowledge of species location in WAU.	Continue potential habitat surveys and follow management guides.
Bald Eagle	Evaluate potential wintering habitat.	Conduct winter surveys.
Marbled Murrelet	Evaluation of habitat in WAU.	Survey suitable habitat.
Northern Goshawk	Increase knowledge about goshawks in WAU.	Conduct incidental and systematic surveys.
Neotropical Birds	Impacts on neotropical species are minimized.	Consider implementing seasonal restriction guides on projects impacting neotropical birds during the breeding season.
Mollusks	Increase knowledge about Survey and Manage mollusk species.	Conduct surveys.
Amphibians	Del Norte salamander distribution is known.	Evaluate survey data and provide a summary of results.
Red Tree Vole	Increase knowledge about the red tree vole.	Complete ongoing surveys and provide a summary of results.
Elk Management	Level of elk management desired by Resource Area.	Develop elk management plan if applicable.
RECREATION		
Recreation	Provide recreation opportunities.	Consider developing recreation opportunities.

I. Characterization of the Watershed

The Cow Creek Watershed Analysis Unit (WAU) is located in the southwest portion of the South River Resource Area in the Roseburg District Bureau of Land Management (see Map 1). The WAU covers approximately 118,340 acres. Located in the lowest reaches of Cow Creek, the WAU lies between Myrtle Creek in the northeast and the West Fork of Cow Creek near the southwest part of the WAU. Elevation ranges from about 560 feet in the northeast near Myrtle Creek to 4,020 feet at Grayback in the southern portion of the WAU. Major towns within this WAU include Tri City and Riddle.

This WAU is composed of seven subwatersheds. These seven subwatersheds are further divided into 38 drainages. The subwatersheds and their drainages are listed below and shown on Map 2.

Lane-Judd Subwatershed - Drainages include Jerry Creek, Judd Creek, Lane Creek, Nickle Mountain, Riddle, Tri City North, Tri City South, and Weaver Road.

Lower Cow Creek Subwatershed - Drainages include Beatty Creek, Buck Creek, Doe Creek, Iron Mountain, Island Creek, Paten Creek, and Salt Creek.

Middle Cow Creek Subwatershed - Drainages include Cattle Creek, Little Dads Creek, and Table Creek.

Upper Cow Creek Subwatershed - Drainages include Darby Creek, Dutchman Creek, Lower Union, Tough Cow, and Upper Union.

LowerMiddle Creek Subwatershed - Drainages include Audie Creek, Buck Martin, Cedar Smith, Hare Creek, Lower Middle Creek, and Martin Creek.

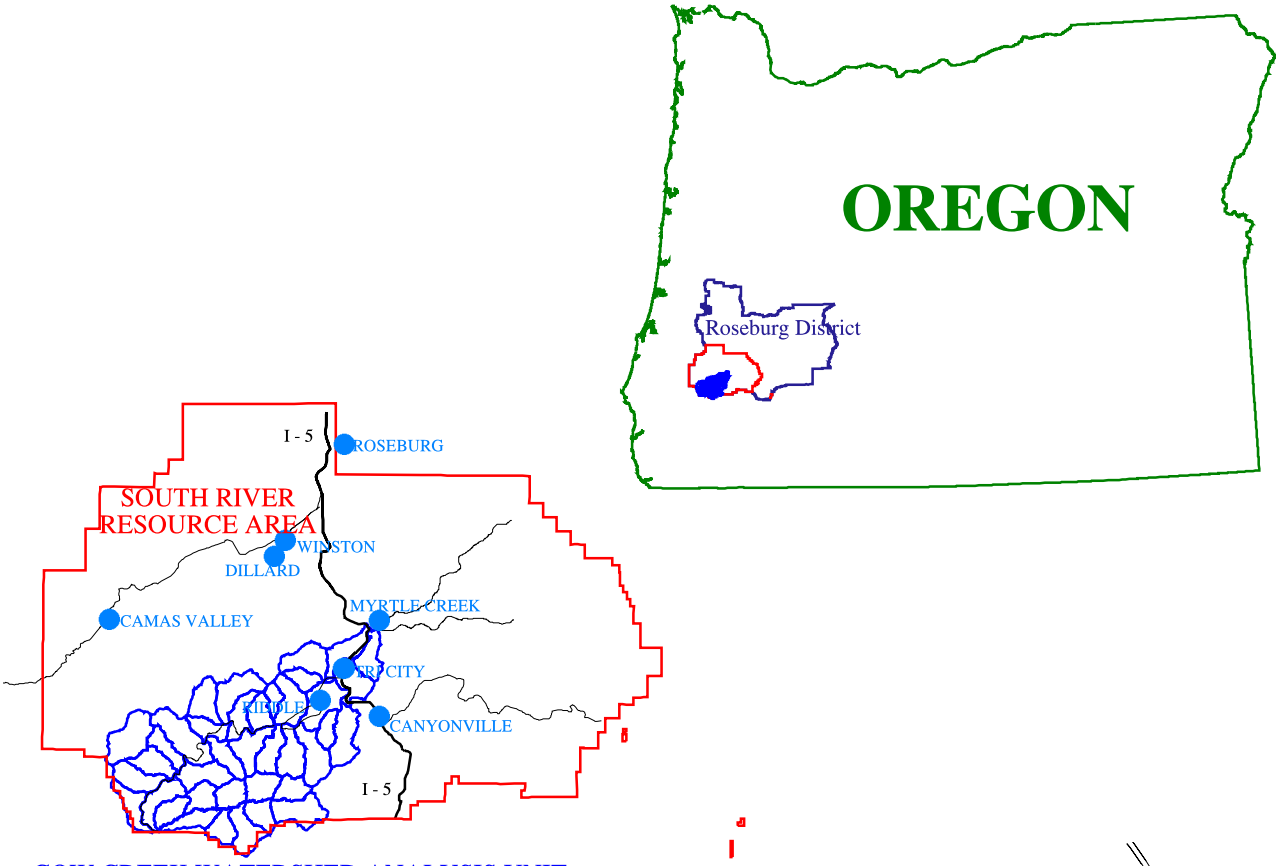
Upper Middle Creek Subwatershed - Drainages include Gravel Brush, Panther Peavine, South Fork Middle Creek, and Upper Middle Creek.

Russel Creek Subwatershed - Drainages include Catching Creek, Council Creek, Mitchell Creek, Russel Creek, and Shoestring.

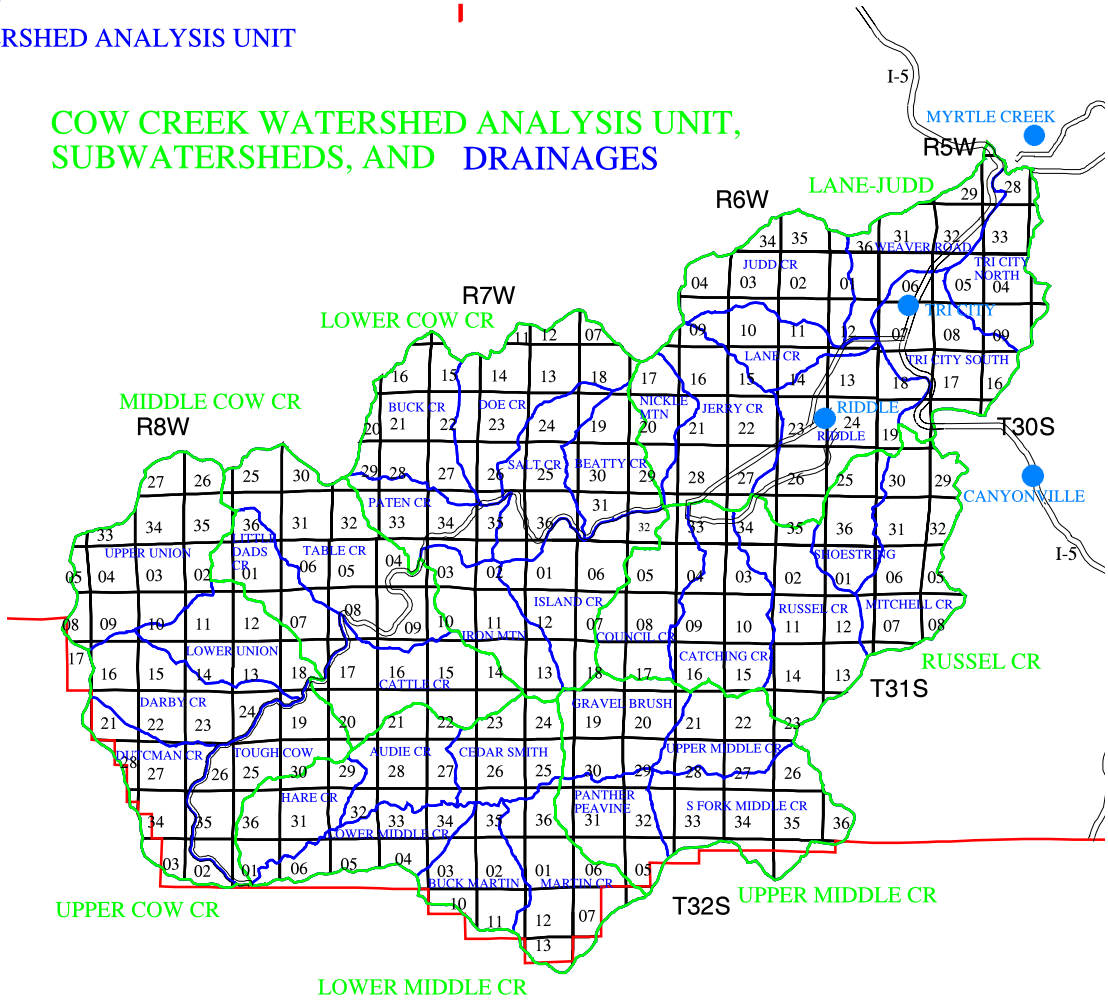
The Bureau of Land Management (BLM) administers approximately 42,447 acres (36%) within the Cow Creek WAU. The Roseburg District manages approximately 42,051 acres and the Medford District manages approximately 396 acres in the WAU. Bureau of Land Management lands are intermingled with private lands in a checkerboard pattern in the upper areas of the WAU. The lower Cow Creek valley is mostly privately owned. Privately owned lands cover approximately 75,882 acres (64%) within the WAU.

Bureau of Land Management administered lands are composed of Matrix, Late-Successional Reserve (LSR), and Riparian Reserve Land Use Allocations established in the Northwest Forest Plan (USDA and

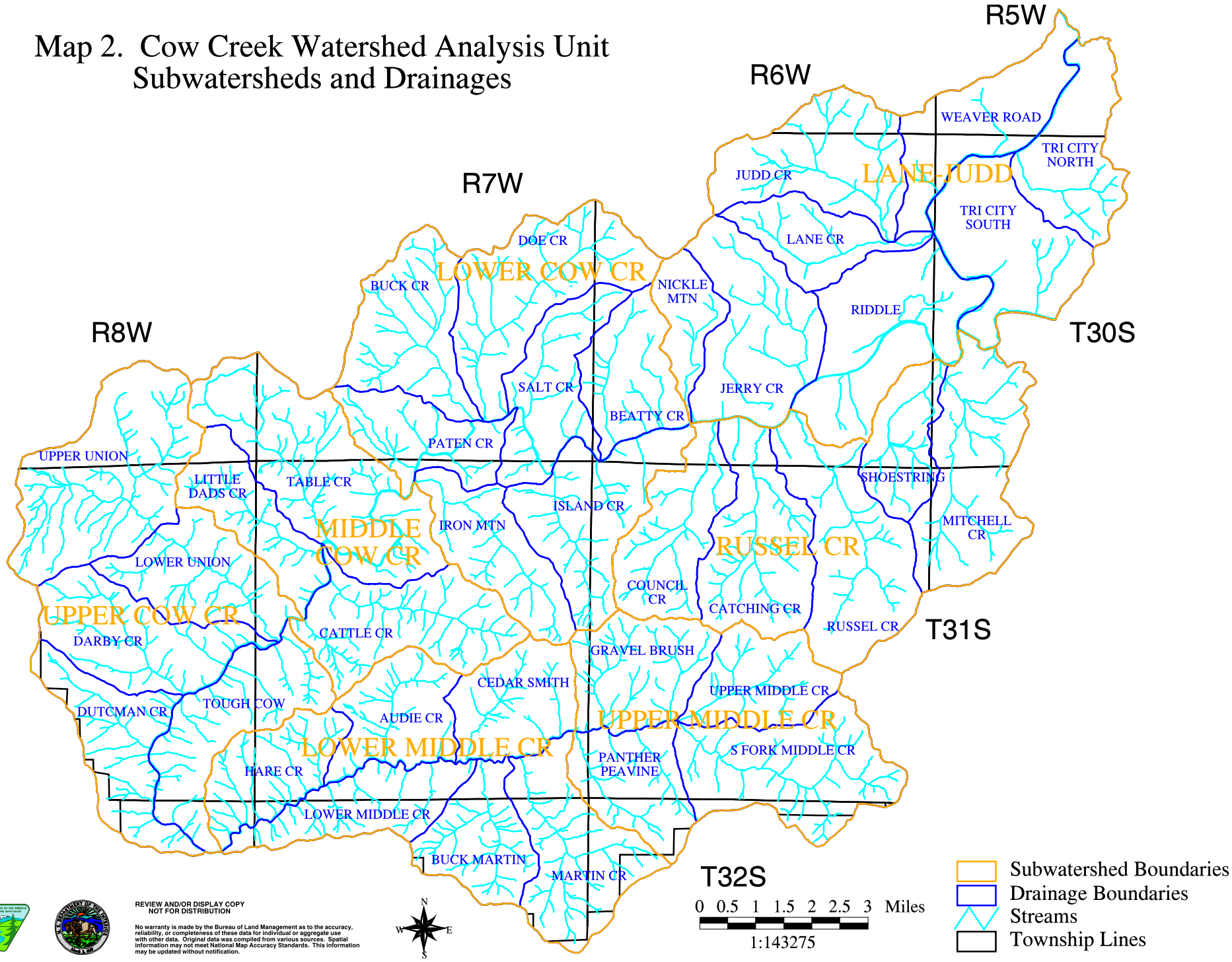
Map 1. Vicinity Map



COW CREEK WATERSHED ANALYSIS UNIT



Map 2. Cow Creek Watershed Analysis Unit Subwatersheds and Drainages



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USDI 1994b) and the Roseburg and Medford District Resource Management Plans (RMP). Matrix lands are further delineated into General Forest Management Areas (GFMA), Northern General Forest Management Area (NFGMA) in the Medford District, and Connectivity. The GFMA and NGFMA will be grouped and considered as GFMA in this watershed analysis. Map 3 and Chart 1 show the percentage of GFMA, Connectivity, and LSR in the WAU and how they are distributed. Table 1 and Chart 2 show the number acres in each land use allocation.

Table 1. Acres and Percentage of Federally Managed Lands by Land Use Allocation.

	Acres in Roseburg District	Acres in Medford District	Total Acres of Federally Managed Lands	Percent of Federally Managed Lands	Percent of Watershed Analysis Unit
Late-Successional Reserve	25,758	0	25,758	61	22
Riparian Reserves (outside of LSR)	7,323	167	7,490	18	6
Other Reserved Areas (Owl Core Areas and TPCC Withdrawn Areas)	2,032	2	2,034	5	2
Connectivity	3,428	107	3,535	8	3
General Forest Management Area (GFMA)	3,510	120	3,630	9	3
Total	42,051	396	42,447	100	36

Middle Creek was designated a Tier 1 Key Watershed in the Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl, Attachment A to the Record of Decision (ROD) for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl (hereafter referred to as SEIS ROD, S&G's). Tier 1 Watersheds were previously identified by the Scientific Panel on Late-Successional Forest Ecosystems (Johnson et al. 1991) and the Scientific Analysis Team Report (Thomas et al. 1993). Tier 1 Key Watershed designation overlays other Land Use Allocations and places additional management requirements on activities within these areas.

Tier 1 Key Watersheds are designed to serve as refugia for maintaining and recovering habitat for at-risk stocks of anadromous salmonids and resident fish species. Key Watersheds with lower quality habitat

Map 3. Cow Creek Watershed Analysis Unit Land Use Allocations

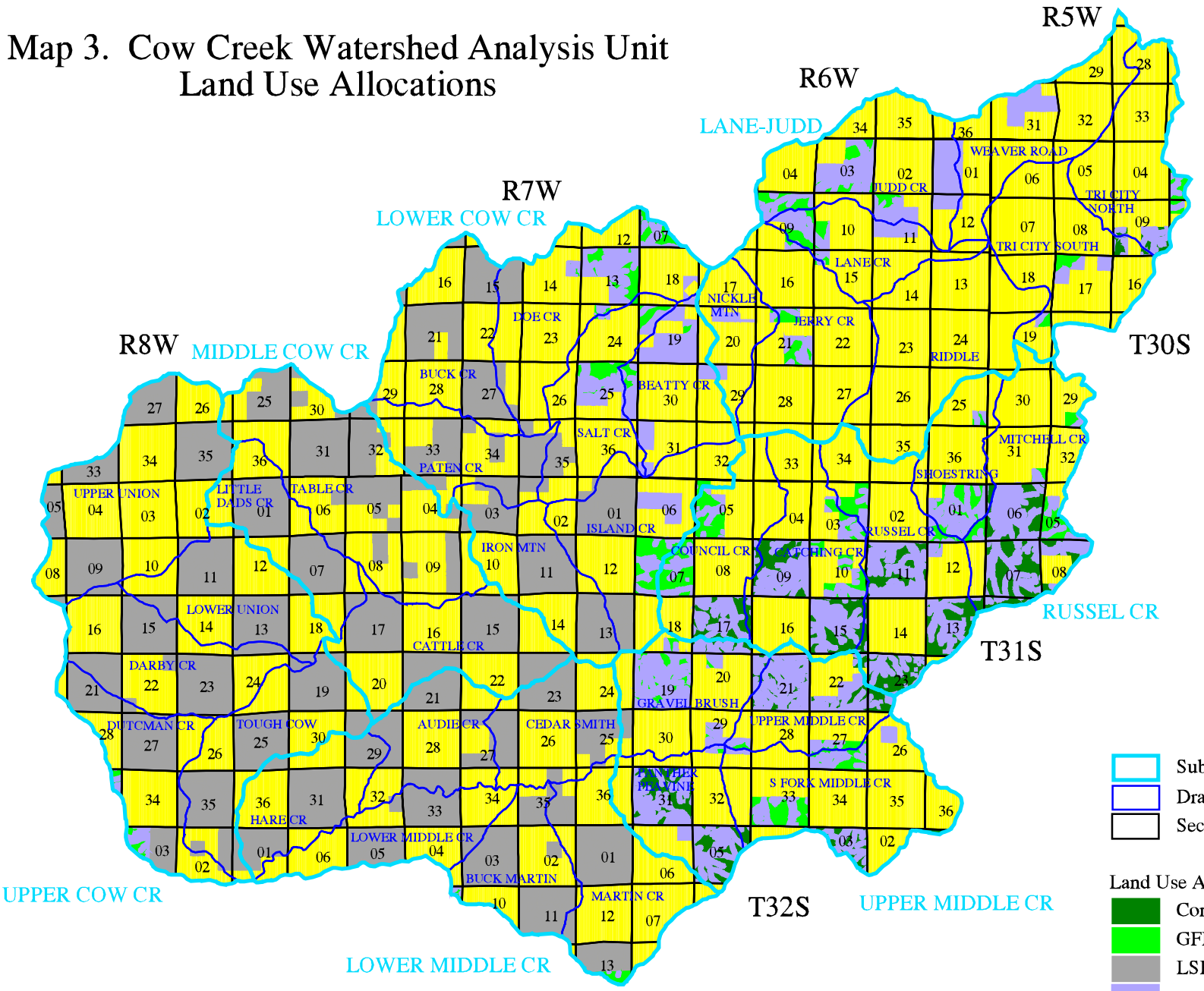

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Chart 1. Cow Creek WAU Total Land Use

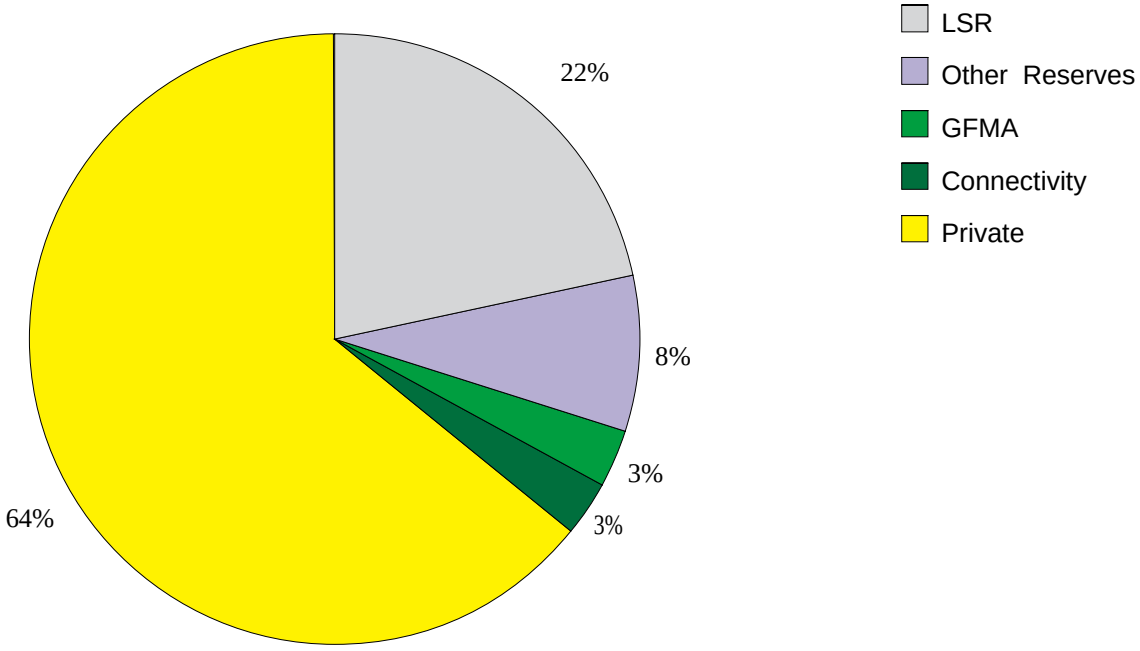
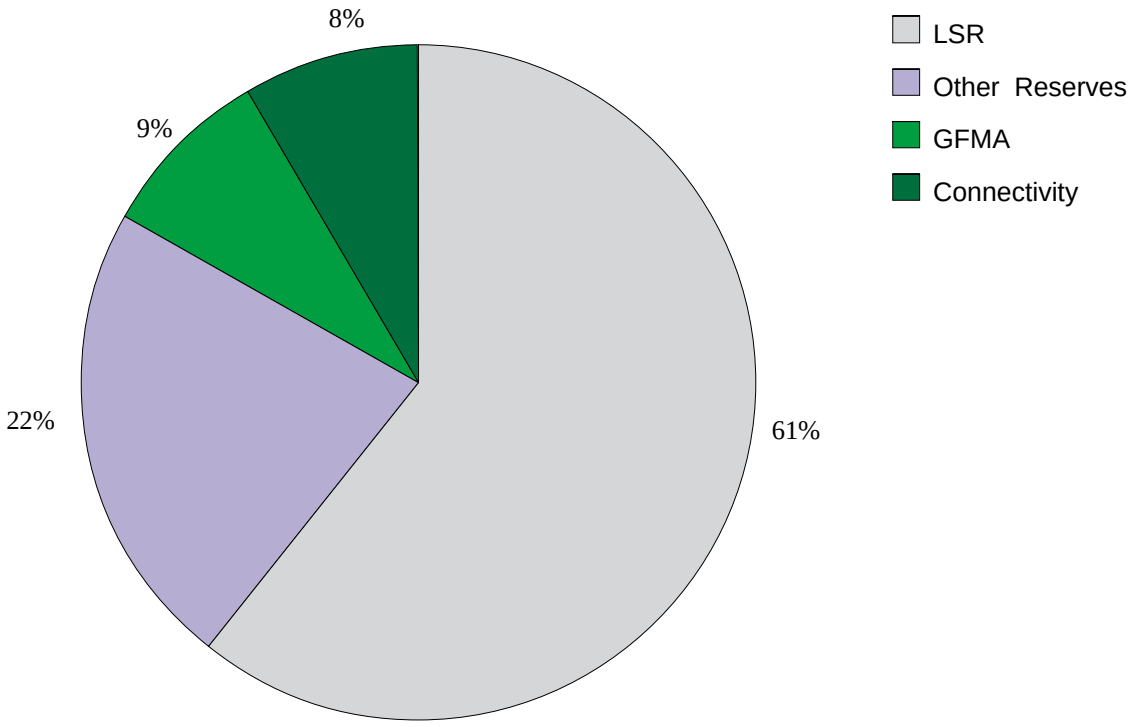


Chart 2. Cow Creek WAU Federal Land Use Allocations



were selected for their high potential for restoration and are designed to become future sources of high quality habitat with the implementation of a comprehensive restoration program (USDA and USDI 1994b).

Management actions and directions on page 20 of the Roseburg District Resource Management Plan (RMP) state three requirements of management activities within Key Watersheds. They are 1) Key Watersheds are given the highest priority for watershed restoration. 2) Watershed analysis is required prior to management activities, including timber harvesting. Minor activities, such as those Categorically Excluded may proceed prior to watershed analysis being completed, if they are consistent with Aquatic Conservation Strategy objectives. 3) Reduce existing road mileage inside Key Watersheds. If funding is insufficient to implement reductions, there will be no net increase in the amount of roads in Key Watersheds.

II. Issues and Key Questions

The purpose of developing issues is to focus the analysis on the key elements of the ecosystem that are most relevant to the management questions, human values, or resource conditions within the WAU. Areas covered by this watershed analysis will receive more in-depth analysis during project development and the National Environmental Policy Act (NEPA) process. New information gathered during the Interdisciplinary (ID) team process will be appended back to the watershed analysis document as an update.

A. ISSUE 1 - Late-Successional Reserve

Late-Successional Reserves are to be managed to maintain a functional and interacting late-successional and old-growth forest ecosystem. A Late-Successional Reserve Assessment will guide the management of the LSR but should be coordinated with watershed analysis.

Key Questions

Vegetation Patterns

What are the natural and human causes of changes between historic and current vegetation conditions?

Where are the late-successional/old-growth stands within the WAU?

Where are the stands that may be treated to maintain or promote late-successional habitat within the LSR?

Where should risk reduction activities occur to protect late-successional/old-growth forests?

B. ISSUE 2 - Tier 1 Key Watershed

Middle Creek has been designated as a Tier 1 Key Watershed. Tier 1 Key Watersheds have been identified as priorities for watershed restoration.

Three components of watershed restoration include road treatments, silvicultural treatments to restore riparian vegetation, and restoring stream channel complexity. Road treatments (such as decommissioning or upgrading) would reduce erosion and sedimentation, and consequently improve water quality. Silviculture treatments such as planting unstable areas along streams, thinning densely-stocked stands, releasing young conifers overtopped by hardwoods, and reforesting shrub and hardwood dominated stands with conifers would improve bank stabilization, increase shade, and accelerate recruitment of large wood desired for future in-stream structure. The design and placement of in-stream habitat structure would increase channel complexity and provide a variety of habitats for fish and other aquatic organisms.

Key Questions

a. Vegetation Patterns

What are the vegetative conditions and seral stages in the riparian areas?

b. Soils / Erosion

What are the dominant erosion processes within the WAU and where have they occurred or are likely to occur?

c. Hydrology / Channel processes

What are the dominant hydrologic characteristics (e.g. total discharge, peak flows, and minimum flows) and other notable hydrologic features and processes in the WAU?

d. Water Quality

What are the limiting factors affecting water quality, and where are the priority opportunities to improve water quality and hydrologic conditions?

What beneficial uses dependent on aquatic resources occur in the WAU and which water quality parameters are critical to these uses?

e. Fisheries

Where are the locations of fish populations, historic and existing?

How have fish habitat and fish populations been affected by hydrologic processes and human activities?

What and where are the priority restoration opportunities to benefit fisheries?

C. ISSUE 3 - Harvest Potential

Matrix lands are responsible for contributing to the Probable Sale Quantity (PSQ). Objectives in the Matrix include producing a sustainable supply of timber and other forest commodities, providing connectivity (along with other land use allocations such as Riparian Reserves) between Late-Successional Reserves, providing habitat for a variety of organisms associated with both late-successional and younger forests, providing for important ecological functions such as dispersal of organisms, carryover of some species from one stand to the next, and maintenance of ecologically valuable structural components such as down logs, snags, and large trees, and providing early-successional habitat.

Key Questions

a. Vegetation Patterns

What are the historic and current vegetation conditions?

Where are the stands of harvestable age within the Matrix?

How can the scale, timing, and spacing of harvest areas be adjusted to minimize fragmentation and maintain the function of large forest blocks?

What opportunities are there in the Elk Management Areas to improve elk habitat through vegetation manipulation?

b. Special Status Species

What is the distribution of species of concern that are important in the WAU (e.g., threatened or endangered species, special status species, or species emphasized in other plans)? What is the distribution and character of their habitats?

How can scheduling of potential harvest areas be prioritized to minimize impacts to wildlife and hydrologic processes while still meeting the objectives for Matrix lands established in the SEIS ROD and the Roseburg District RMP?

III. / IV. Reference and Current Conditions

A. Human Uses

1. Reference Conditions

The Cow Creek Watershed Analysis Unit has been used by humans probably for thousands of years. Little knowledge exists of prehistoric use of the WAU prior to Euroamerican entry. Six archaeological sites have been recorded in the WAU on BLM administered land, with the majority located in the Middle Creek drainage. Three sites have been recorded on private land near the town of Riddle.

The Cow Creek Indians followed a seasonal way of life utilizing a variety of plants and animals. They gathered nuts, berries, seeds, and roots, hunted deer and elk, and fished for salmon. The aborigines utilized the Cow Creek WAU for salmon and camas which provided a large portion of their diet. The Indigenous people changed the landscape of the WAU very little, although they did burn areas to control brush and to aid in the collection of tar weed seeds for food. George Riddle mentioned a large Indian encampment near the current town of Riddle.

The 1800s marked the arrival of the fur trappers and settlers into the Cow Creek Valley. Euroamericans transformed the life and landscape of the area and began the process of shaping it into its current condition. Exploration by fur trappers from the Northwest Fur Company and the Hudson Bay Company began around the 1820s. In 1826 and 1827 Peter Skene Ogden lead a brigade of trappers through the Cow Creek area passing Darby Creek and following Union Creek to the Coquille River. On their return they followed Cow Creek to its confluence with the South Umpqua River and then proceeded down the South Umpqua River as far as the present day town of Myrtle Creek. Ogden's brigade discovered numerous signs of Hudson Bay Company trappers in the area. They were informed by the local natives that an Umpqua Chief with six trappers from the Willamette Valley had taken all the beaver. Alexander McLoed's Umpqua brigade was probably in the region during the winter of 1826-1827. The two fur trapping companies provided the earliest exploration of the area within a very short time span. This led the way for other people to follow, such as Ewing Young who drove 800 head of long horn cattle from California to the Willamette Valley in 1837.

Jesse and Lindsay Applegate, along with Levi Scott, surveyed the area for a new emigrant trail into Oregon from the south. By the fall of 1846 the Applegate Trail opened a new route for emigrants into the Willamette Valley. The pioneering of the Applegate Trail, along with the passage in 1850 of the Donation Land Claim Act, opened the region to settlers. The primary period of settlement in the Cow Creek area was between 1850 and 1900. William Riddle and W.G. Hern were the first to acquire claims in the Cow Creek Valley near the present town of Riddle. The presence of gold brought miners to the region by 1851. Herman and Charles Reinhart came to the region in 1851 in search of gold. They both filed donation land claims. Herman Reinhart made reference to the trees as the best yellow and red cedar he had ever seen.

Mining continued from the earlier claims to placer mining and the construction of hydraulic ditches to aid in the process. Eight hydrologic ditches are present within the WAU.

Nickel ore from Nickel Mountain was the most important mineral resource in Douglas County. In 1882 the mining of nickel ore began but was very modest. It was not until 1947 that a major commercial operation began under the Hanna Company. The mine provided a major source of employment for Riddle and Myrtle Creek.

The influx of settlers and miners produced hostilities between the new arrivals and the Native Americans. Wars erupted throughout Southern Oregon. To bring peace, Joel Palmer negotiated a treaty with the Cow Creek Indians near Council Creek on September 19, 1853. The treaty was later ratified on April 12, 1854, creating a reservation for the Cow Creek Indians on Council Creek. Two years later the reservation was closed.

Early settlers indicated that the valley bottoms needed minimal clearing, probably because the indigenous people burned the valley bottoms. A brief review of cadastral survey notes from the mid-nineteenth century indicated grasslands occurred on the valley floor, oak openings on the mid-slopes, and timber on the upper slopes. The vegetation regime appears to be similar to what is shown on the 1936 vegetation map.

Agriculture and mining were the principal activities that drew Euroamerican settlers to the area in the 1850s. Small farms and gold mines were the focus for several years until mining activity subsided and commercial agricultural products provided the main economics of the Cow Creek Area. The early settlers maintained a subsistence lifestyle until markets were established for grain and livestock. These were the main sources of income throughout the 1880s and 1890s. The products were transported to markets by pack animals or wagons and the cattle were driven to market. In the 1880s the area became a rail transportation route. The introduction of rail service allowed agriculture to have an influence on the local economy. From the 1880s until their decline in the 1930s, Italian Prunes were the main agricultural production crop in the valley. Orchards were located in the valleys accompanied by associated prune driers.

The completion of the Oregon and California (O&C) railroad opened the possibility of new markets for people settling in the Cow Creek WAU. By 1882 the rail line was constructed to Riddle opening a new avenue of transportation to the north. In 1889 completion of the rail line through the Cow Creek WAU to the south opened markets in Southern Oregon and California. In 1897 Judge Riddle operated a lumber mill on Doe Creek which produced railroad ties and fuel. The mill fostered a store and post office at the Doe Creek site.

By 1906 small scale mills began to appear in the Riddle area. Dunbar and Ross, and Sto-man Lumber Company both began production. Timber harvesting became the major influence on the Cow Creek WAU landscape in the 1950s. The construction of access roads into the Cow Creek WAU in the 1950s and 1960s opened the area to intensive timber harvesting and management on both private and BLM administered lands. The Cow Creek road to Doe Creek was built in 1958 with the segment to the junction

of the West Fork of Cow Creek being built in 1961. The Council Creek road was constructed in 1955 and the portion on Middle Creek was built in 1959.

2. Current Conditions

The dominant human uses in the Cow Creek WAU are timber production, agriculture, transportation, and service-related. This includes a broad spectrum of uses from hunting and gathering, fur trapping, subsistence and commercial agriculture, transportation, logging and lumbering, mining, and recreation. There are no treaty rights or tribal uses in the WAU, although individual tribal members may utilize the area.

Service-related uses include providing food, gas, and lodging for tourists and commercial travelers in addition to local residents. The communities of Riddle and Tri City provide these services in the WAU.

a. Timber

Timber harvesting has had the most influence on the area, with both private and federal land contributing to the timber harvest over the last 45 years. Approximately 41% (48,483 acres) of the Cow Creek WAU has been harvested. Forest products are important to the local economy, providing jobs and revenue to local inhabitants.

The checkerboard ownership and the limited amount of lands the BLM administers in the WAU limits the ability of the BLM to affect human use within the WAU. The main human use issue in the WAU is the amount of timber harvesting that will occur in the future. A diminished level of harvest has occurred on BLM administered lands and will probably persist into the future. Timber harvesting will probably continue to occur, depending on market conditions, on private land.

b. Agriculture

There are approximately 11,107 acres (9%) of agricultural/pasture lands within the WAU. A variety of grain and fruit crops have been important in the past, giving way to the present attention to livestock, both sheep and cattle.

c. Mining and Minerals

There are 18 mining sites and 21 quarries within the Cow Creek WAU. During earlier times mining for gold and nickel was of major interest. The Nickel Mine on Nickel Mountain and the Silver Butte Mine are located in the WAU. There are still some small mining operations occurring in the WAU. Foreign competition has made the mining of nickel unprofitable at this time.

The Silver Butte Mine was discovered in 1910, mining operations continued until 1936. In 1990, the Oregon Department of Geology and Mineral Industries (DOGAMI) issued an operating permit to Formosa Exploration, Inc. for the Silver Butte Mine. The mine produced gold, silver, copper, and zinc. The mine was Oregon's only operating copper mine and only significant producing underground mine.

Patented lands cover 1,460 acres in three blocks. The blocks are located in T31S, R6W, sections 13, 23, 26, and 27 and in T32S, R6W, sections 5 and 8.

Discharges from the Silver Butte Mine probably have been negatively affecting Middle Creek for approximately 80 years. Baseline data was collected, concerning metals and pH levels in Middle Creek and the South Fork of Middle Creek, before Formosa started operations in 1990. In May 1988, tests found metal levels below or near detection limits in the South Fork of Middle Creek, but the copper level in Middle Creek exceeded the Oregon State water quality standards. The pH levels in Middle Creek were 7.0 and 7.4 in the South Fork of Middle Creek. A survey indicated the presence of fish in Middle Creek prior to Formosa starting operations.

Production at the mine ceased in August 1993 after Formosa Exploration received a Closure Order from the Oregon Department of Geology and Mineral Industries and a Notice of Noncompliance from the Oregon Department of Environmental Quality.

A spill contaminated the mainstem of Middle Creek with an estimated 20 tons of pyrite and other metal-bearing sulfide minerals. Most of the contaminated material was contained behind the first road crossing below the mine but was spread over about 4,000 feet of stream length. While most of the sulfide contaminants were trapped behind the 31-6-28.0 road, small quantities were readily visible one mile down stream of the culvert and the creek is effectively "dead" with no signs of life farther down stream. A fish survey in the summer of 1993 showed no fish in Middle Creek above the confluence with the South Fork of Middle Creek.

An inspection by DOGAMI on March 14, 1994 detected no fish or aquatic insects in approximately two miles of stream between the end of the sulfide materials and where the South Fork of Middle Creek and Middle Creek join. Three dead fish were found fifty feet below the confluence of Middle Creek and the South Fork of Middle Creek on March 17, 1994.

The sulfides were removed from Middle Creek, the process also removed all organic material from the stream bed. The organic material may have filtered metals from the stream. On May 11, 1994, after the cleanup, the pH in Middle Creek ranged from 7.2 to 7.5 and 7.4 in the South Fork of Middle Creek. On June 8, 1994 one salamander was reported in Middle Creek, but there were no macro-invertebrates and the pH was 6.6 in Middle Creek.

Drainage pipes installed during reclamation of the mine failed and water drained into Middle Creek. Benthic invertebrate monitoring of Middle Creek in 1994 and 1995 indicated the macro-invertebrate community in the creek was severely impacted from metals. Recovery of intolerant or long-lived taxa was

not evident in 1995. Compared to 1989 data there was a substantial drop in taxa richness in the invertebrate groups that could be compared between data sets.

Water from a mine adit was draining into Middle Creek according to a letter from DOGAMI on March 19, 1996. However, in a status update dated April 1996, no clear relationship had been established between zinc, copper, or pH values with stream cleanup, adit water, discharges, or precipitation. The data did show an annual fluctuation with higher metal values during the winter. Metal values were generally higher in the two winters after cleanup was completed, but the background values in the South Fork of Middle Creek also rose dramatically. After numerous years of abnormally dry weather, larger amounts of metals were probably being flushed from drainages which have anonymously high metal values. It may be that the mine is not the sole contributor of metals to Middle Creek.

The drain field was reconstructed in November 1996. On January 14, 1997 the water was clear in Middle Creek and there was no precipitate on rocks in the stream. The pipes and drain field appeared to be working. Water quality samples taken in January 1997 showed some of the lowest metals in Middle Creek since the mine closed.

The construction of roads within the Cow Creek WAU has led to the development and mining of rock quarries to provide surfacing material. Surfacing rock will continue to be in demand in this WAU and may be used to reduce sediment and soil erosion through upgrading roads.

d. Recreation

The mix of land ownership, topography, forest types, and stand ages determines the recreation uses of the area. There is one designated recreation site within the WAU. Special Use Permits are not required for recreation use in the WAU.

The Recreation Opportunity Spectrum (ROS) designation for the Cow Creek WAU is listed as Roaded Natural, characterized by a natural appearance yet still accounting for the moderate evidence of man. Resource modification and utilization practices are evident, but harmonize with the natural environment. Rustic facilities are provided for user convenience as well as for safety and resource protection. Facilities are designed and constructed to provide for conventional motorized use.

The predominant Off Highway Vehicle (OHV) designation in the RMP for the Cow Creek WAU is 'Limited' to existing roads and trails. Under this designation, existing roads and trails are open to motorized access unless otherwise identified (e.g. hiking trails). Licensed vehicles may use maintained roads and natural surface roads and trails, however, registered OHVs such as All Terrain Vehicles (ATVs) and motorcycles not licensed for the public roads may only use existing roads and trails that are not maintained (graveled). One hundred and sixty acres of land along Beatty Creek known as the Beatty Creek Research Natural Area is 'Closed' to OHV travel for site protection due to the fragileness of the site.

The Cow Creek corridor is a Special Recreation Management Area (SRMA), but the remainder of the Watershed Analysis Unit falls within the South River Extensive Recreation Management Area (ERMA). Within the SRMA, recreation is mainly in developed sites or areas offering interpretive opportunities, intended to limit impact. Within the ERMA, recreation is mainly unstructured and dispersed requiring minimal recreation investment. The Extensive Recreation Management Area, which constitutes the bulk of the BLM administered land in the WAU, gives recreation visitors the freedom of choice with minimal regulatory constraints.

The Cow Creek WAU contains Class II and Class IV Visual Resource Management (VRM) classifications. Under VRM Class II, low levels of change to existing landscape characteristics are allowed, whereas VRM Class IV allows for major modifications. Class II lands are those lands within the SRMA which are within 1/4 mile on either side of Cow Creek. Outside of the 1/4 mile margins, lands are classified as VRM Class IV. The objective of Class IV lands is to provide for management activities which require major modifications to the existing character of the landscape. The level of change to the character of the landscape can be high. Management activities may dominate the view and may be the major focus of the viewer's attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic elements of form, line, and texture.

Forms of recreation commonly observed in the Cow Creek WAU include driving for pleasure, hunting, photography, picnicking, camping, target shooting, and gathering (berries, flowers, mushrooms, greens, and rocks). Some of the most popular areas used for these forms of recreation include driving for pleasure along the Cow Creek Road which is a Back Country Byway; the Gold Panning Area in T31S R8W section 35 used for public gold panning and picnicking; a camping, gold panning, and water play area at Island Creek in T31S R7W section 1; and a summer water play area at Rattlesnake Creek in T30S R6W section 31.

Potential recreation development includes a public gold panning, day use, primitive campground, and watchable wildlife site along Island Creek in T31S R7W section 1; a trailhead for the Cow Creek Bluffs Trail in T30S R7W section 35 near Doe Creek; a public gold panning site, trail head for the Cow Creek Bluffs Trail, and watchable wildlife site for salmonids along Iron Mountain Creek in T31S R7W section 4; the Salt Creek Trail through Jeffrey Pine stands on serpentine based soils in T30S R6W section 19 and T30S R7W sections 24,25,26, and 35; and the Cow Creek Bluffs Trail through the bluffs overlooking Cow Creek in T30S R7W sections 27,32,33,34, and 35, and T31S R7W sections 4 and 5.

The Cow Creek corridor has the most diverse potential for recreation within the South River Resource Area. It currently contains the Back Country Byway, Public Gold Panning Area, a portion of the Glendale to Powers Bikeway, and numerous dispersed use areas. With its scenery along the waterway and the asphalt surfacing through forested lands, it will continue to hold its allure to the general public. Glendale economic development groups have considered nominating Cow Creek to the Oregon State Scenic Tour Route system. With the existing and potential recreation uses along the corridor, it would be wise to consider recreational value in pending plans for the other resource uses within the WAU.

B. Vegetation

1. Historical Perspective and Reference Vegetation Conditions

A map in the Roseburg District BLM Geographic Information System (GIS) gives general forest type descriptions of vegetation in 1936 for Douglas County in terms of diameter class and species (see Map 4 and Table 2). Although the map scale is large and lacks detail, the type map may be used to compare vegetation conditions in 1936 with current vegetative conditions.

The 1936 diameter classes may be correlated to current age classes. The 0 to 6 inch diameter classes are correlated with stands between 0 and 30 years old. These classes are labeled Early Seral. Diameter classes 6 to 20 inches are correlated to stands between 30 and 80 years old. These classes are labeled Mid Seral. Diameter classes greater than 20 inches are correlated to stands greater than 80 years old. These classes are labeled Late Seral. Agricultural land was also identified in the 1936 vegetation type map. The agricultural land may be correlated with the nonforest lands used in the current vegetation type descriptions.

In 1936, there was less fragmentation of age classes over the land. All structural classes ranging from early to late seral were represented in large blocks. The Cow Creek Watershed Analysis Unit was considered to be 15% in agricultural land, 6% early seral, 19% in mid seral, and 61% in late seral in 1936.

a. Fire History and Natural Fire Regimes

Fire has been an important disturbance factor in Pacific Northwest forests for thousands of years. The "unmanaged"or "natural" forests, those that developed before widespread logging or fire protection existed, were initiated by fire and most have been altered by fire since establishment. Early accounts suggest that fires were sometimes infrequent and sometimes common; sometimes killed all the trees and sometimes left the mature trees unscathed (Agee 1990).

Fire regimes of the Pacific Northwest have been described by Agee (1981). Fire regimes are broad, artificially grouped categories, which overlap considerably with one another. Forests are considered to have a similar fire regime when fires occur with similar frequency, severity, and extent. Effects of forest fires can be more precisely described if areas can be grouped by fire regimes. The Cow Creek WAU is considered to have a high-severity regime; where fires are very infrequent (more than 100 years between fires) and are usually high-intensity, stand replacement fires. High-severity fire regimes typically occur in cool, moist forest types. In high-severity fire regimes, fires occur under unusual conditions such as during drought years, during east wind weather events (hot and dry foehn winds), and with an ignition source such as lightning. Fires are often of short duration (days to weeks) but of high intensity and severity (Pickford et al. 1980). Most of the Roseburg BLM District administered lands are classified as being in the high-severity fire regime, which is common to the coastal mountains of Oregon, the middle to northern Cascades, the Olympic Mountains, and other typical westside forests.

Map 4. Cow Creek Watershed Analysis Unit 1936 Vegetation Size Classes

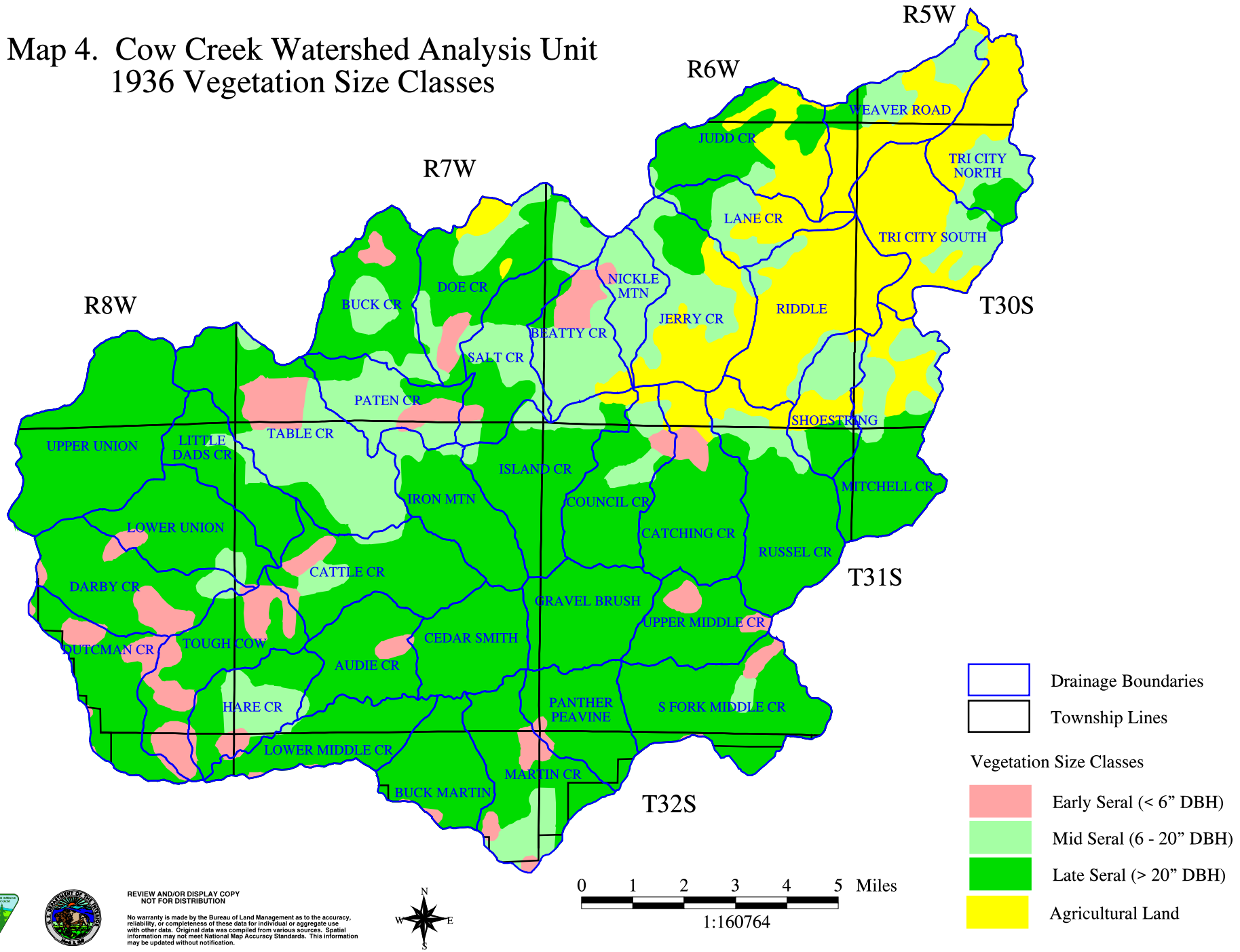


Table 2. Cow Creek WAU 1936 Vegetation.

	Agricultural Lands		Early Seral (< 6" DBH)		Mid Seral (6 - 20" DBH)		Late Seral (> 20" DBH)		
Area	Acres	%	Acres	%	Acres	%	Acres	%	Total
Jerry Creek	1,837	47	0	0	1,518	39	523	13	3,878
Judd Creek	1,523	42	0	0	166	5	1,974	54	3,663
Lane Creek	819	42	0	0	715	37	402	21	1,936
Nickle Mountain	15	1	76	6	1,223	93	0	0	1,314
Riddle	3,955	91	0	0	411	9	0	0	4,366
Tri City North	1,624	58	0	0	792	28	369	13	2,785
Tri City South	2,765	78	0	0	723	20	59	2	3,547
Weaver	1,903	62	0	0	906	29	274	9	3,083
Lane-Judd Subwatershed	14,441	59	76	0	6,454	26	3,601	15	24,572
Beatty Creek	148	6	520	22	1,553	66	129	5	2,350
Buck Creek	0	0	152	5	738	23	2,349	73	3,239
Doe Creek	378	9	268	6	1,577	37	1,987	47	4,210
Iron Mountain	0	0	12	0	380	15	2,217	85	2,609
Island Creek	116	3	0	0	555	16	2,901	81	3,572
Paten Creek	0	0	316	14	1,313	59	588	27	2,217
Salt Creek	0	0	86	3	1,029	38	1,567	58	2,682
Lower Cow Creek Subwatershed	642	3	1,354	6	7,145	34	11,738	56	20,879
Cattle Creek	0	0	276	8	396	11	2,980	82	3,652
Little Dads Creek	0	0	0	0	227	10	2,032	90	2,259
Table Creek	0	0	732	13	2,990	53	1,899	34	5,621
Middle Cow Creek Subwatershed	0	0	1,008	9	3,613	31	6,911	60	11,532
Darby Creek	0	0	549	16	197	6	2,617	78	3,363
Dutchman Creek	0	0	504	18	0	0	2,343	82	2,847
Lower Union	0	0	108	4	163	6	2,647	91	2,918
Tough Cow	0	0	1,306	39	42	1	1,972	59	3,320
Upper Union	0	0	0	0	0	0	5,245	100	5,245
Upper Cow Creek Subwatershed	0	0	2,467	14	402	2	14,824	84	17,693

	Agricultural Lands		Early Seral (< 6" DBH)		Mid Seral (6 - 20" DBH)		Late Seral (> 20" DBH)		
Area	Acres	%	Acres	%	Acres	%	Acres	%	Total
Audie Creek	0	0	132	6	38	2	2,230	93	2,400
Buck Martin	0	0	34	1	0	0	2,237	99	2,271
Cedar Smith	0	0	8	0	0	0	2,450	100	2,458
Hare Creek	0	0	211	9	913	39	1,199	52	2,323
Lower Middle Creek	0	0	32	1	35	1	2,321	97	2,388
Martin Creek	0	0	347	10	748	21	2,387	69	3,482
Lower Middle Creek Subwatershed	0	0	764	5	1,734	11	12,824	84	15,322
Gravel Brush	0	0	0	0	0	0	2,776	100	2,776
Panther Peavine	0	0	73	3	0	0	2,284	97	2,357
South Fork Middle Creek	0	0	186	4	148	4	3,823	92	4,157
Upper Middle Creek	0	0	297	13	0	0	2,014	87	2,311
Upper Middle Creek Subwatershed	0	0	556	5	148	1	10,897	94	11,601
Catching Creek	501	14	271	7	39	1	2,827	78	3,638
Council Creek	110	4	127	4	517	18	2,100	74	2,854
Mitchell Creek	901	22	0	0	1,040	25	2,206	53	4,147
Russel Creek	482	11	0	0	596	14	3,172	75	4,250
Shoestring	514	28	0	0	831	45	505	27	1,850
Russel Creek Subwatershed	2,508	15	398	2	3,023	18	10,810	65	16,739
Cow Creek Watershed Analysis Unit	17,591	15	6,623	6	22,519	19	71,605	61	118,338

Other fire regimes exist within the Cow Creek WAU. Lower elevations along Cow Creek have more open, grass covered forest types that transition to Western hemlock/Douglas-fir forests. The transition occurs with changes in aspect and elevation.

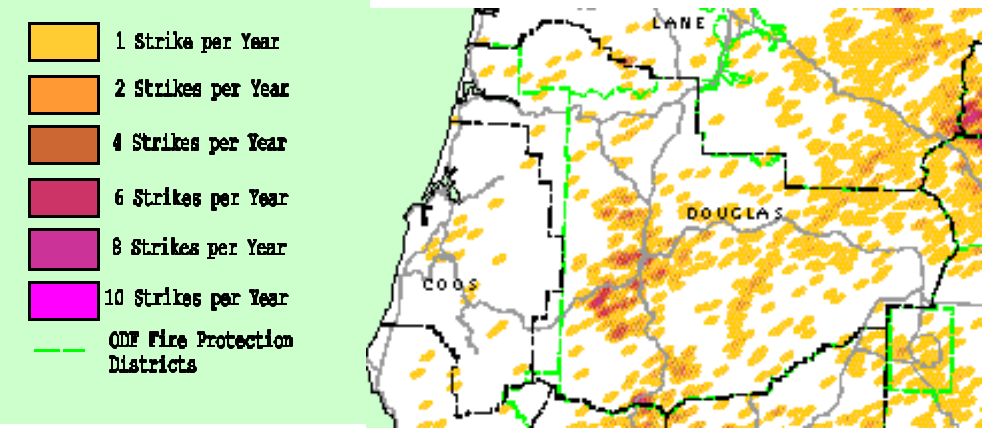
Accurate fire return intervals have never been calculated in Pacific Northwest forests, because the intervals between fires are long and may not be cyclic (Agee and Flewelling 1983). On drier sites, forests may burn every 100 to 200 years. Fahnestock and Agee (1983) estimated the regional average at 230 years. Douglas-fir begins to be replaced by the more shade tolerant western hemlock at approximately 250 years old and continues until about 700 to 1,000 years old, when the western hemlock dominates the stand. The cycle from Douglas-fir to western hemlock is rarely completed because fires, which create stand openings allowing Douglas-fir to regenerate, usually occur before Douglas-fir disappears from the stand (Agee 1981).

b. Recent Fire History

Fire suppression during the past 75 years has been successful at minimizing the number of forested acres lost to wildfire. During this same period prescribed fire has been used extensively. The pattern of prescribed fire use has evolved in the last 50 years. Originally, prescribed fire was used almost exclusively for reducing fire hazard. More recently the emphasis has shifted to using prescribed fire for site preparation prior to reforestation (Norris 1990).

Lightning is the primary natural source of forest fires in the world. Although the Pacific Northwest has relatively mild thunderstorm activity compared to the southeastern United States, the average annual number of lightning caused fires is greater in the West because less precipitation accompanies the thunderstorms (Agee 1993). Considerable variation in thunderstorm tracking patterns exists from year to year and from storm to storm, some being widespread and others consisting of localized events (Morris 1934). The lightning strike frequency map (Map 5) shows less than 1 lightning strike per year occurred over most of the Roseburg District during the four year period from 1992 to 1996. This map graphically displays the widespread and random distribution of lightning across Douglas County but gives no indication of which lightning strikes may have ignited wildfires.

Map 5. Number of Lightning Strikes in Douglas County from 1992 to 1996.



The 1987 Buck Creek Fire in the Lower Middle Creek Subwatershed is an example of a stand replacing fire that has affected how age classes are distributed. It was started by lightning and burned approximately 1,486 acres. From 1980 to 1994 there were 36 fires within the Cow Creek WAU that burned approximately 2,872 acres. Most of the fires were caused by lightning.

Nineteen eighty-seven was the most severe fire year in the last 50 years, and one of the two worst in the last 120 years, yet the acreage burned was only 30 percent of the average acreage historically burned by wildfire in Oregon. Modern fire suppression and fire management strategies have had a profound effect on natural fire frequency and intensity, species composition, vegetative density, and forest structure in many forests in the Pacific Northwest (Norris 1990).

The combined effects of fire suppression, timber harvesting followed by prescribed burning, and occasional wildfires have shaped current forest conditions in the Cow Creek WAU. Discussing these forests in terms of natural fire regime helps explain why species composition and forest density has changed with human management, dating back thousands of years when native Indians set fires as a means of improving areas for foraging. In many forests of the West, years of successful fire suppression have created unnatural fuel accumulations causing fires to be more destructive, burning with greater intensity and in fire regimes where stand replacement fires would rarely occur in a "natural" forest. Forest health has declined in many areas because fire has been excluded. Fire suppression has probably had little or no effect on fuel accumulation on the westside (with the exception of southwest Oregon) where the natural fire regime has a long return interval (Norris 1990).

2. Current Vegetation Conditions

Various vegetation age classes have been documented in the Cow Creek WAU. For this analysis, vegetation on BLM administered lands is described by the age of the dominant conifer cover for each stand. The stands are aggregated into selected age class groupings because they represent an array of wildlife habitat types (see Table 3 and Map 6). Private lands are aggregated by the same age class groupings, using a dominant conifer or hardwood stand age. Acres of nonforested lands, including agricultural lands, are also identified. The arrangement of these age classes on the landscape within the WAU is a result of historic and recent natural (e.g., fire and blowdown), and human caused disturbance (e.g., introduced fire for clearing, tree harvesting, road construction, home building, and division of land by straight line boundaries).

In 1997, the Cow Creek Watershed Analysis Unit is comprised of approximately 16% in agricultural land, 30% early seral, 19% in mid seral and 34% in late seral conditions (see Table 4 and Map 7). All structural classes ranging from early to late seral are present, although in smaller blocks than what occurred in 1936. Generally, the late seral stands have been converted to early seral stands.

There is a great diversity of plant communities within the Cow Creek WAU. Vegetative diversity is partially the result of dramatic climatic gradients. In addition, a wide variety of soils and related geologic features directly affect local plant distribution and the resulting plant communities. The Cow Creek WAU

Table 3. Acres by Age Class on BLM Administered Lands.

	Number of Acres by Age Class and Percent of Total																		
AREA	Nonforest	%	< 5	%	10	%	20	%	30 to 40	%	50 to 70	%	80 to 110	%	120 to 190	%	200 +	%	TOTAL
Weaver Road	125	46	0	0	0	0	0	0	1	0	0	0	104	38	36	13	5	2	271
Tri City North	33	12	0	0	54	20	0	0	48	17	0	0	1	0	67	24	72	26	275
Tri City South	14	5	0	0	0	0	0	0	25	10	8	3	142	54	39	15	34	13	262
Judd Creek	21	2	0	0	141	11	110	9	287	23	6	0	49	4	358	29	263	21	1,236
Lane Creek	6	1	0	0	116	26	87	19	20	4	0	0	126	28	32	7	59	13	447
Riddle	3	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Jerry Creek	0	0	0	0	8	3	11	4	111	43	0	0	14	5	13	5	104	40	260
Nickle Mountain	1	1	0	0	0	0	0	0	1	1	0	0	0	0	31	29	75	70	107
Lane-Judd Subwatershed	203	7	0	0	319	11	208	7	493	17	14	0	436	15	576	20	612	21	2,861
Beatty Creek	14	2	0	0	2	0	0	0	0	0	0	0	0	0	665	95	17	2	698
Doe Creek	47	4	0	0	140	13	251	24	195	19	0	0	14	1	65	6	337	32	1,049
Salt Creek	47	6	0	0	85	11	107	14	18	2	29	4	40	5	240	32	178	24	743
Island Creek	154	11	0	0	170	12	256	18	8	1	106	7	0	0	40	3	716	49	1,448
Buck Creek	45	3	0	0	172	12	184	13	0	0	0	0	22	2	204	15	750	54	1,377
Paten Creek	276	26	0	0	2	0	0	0	0	0	7	1	70	7	348	33	365	34	1,068
Iron Mountain	93	7	0	0	81	6	177	13	0	0	4	0	0	0	0	0	970	73	1,325
Lower Cow Creek Subwatershed	676	9	0	0	652	8	975	13	221	3	146	2	146	2	1,562	20	3,333	43	7,708
Table Creek	388	16	0	0	114	5	56	2	147	6	46	2	360	15	406	16	963	39	2,479
Little Dads Creek	56	5	0	0	269	22	153	13	0	0	27	2	112	9	0	0	582	49	1,199
Cattle Creek	61	3	0	0	193	11	143	8	192	11	0	0	152	9	178	10	838	48	1,757
Middle Cow Creek Subwatershed	505	9	0	0	576	11	352	6	339	6	73	1	624	11	584	11	2,383	44	5,435

	Number of Acres by Age Class and Percent of Total																		
AREA	Nonforest	%	< 5	%	10	%	20	%	30 to 40	%	50 to 70	%	80 to 110	%	120 to 190	%	200 +	%	TOTAL
Lower Union	10	1	0	0	307	23	133	10	137	10	0	0	111	8	0	0	634	48	1,332
Upper Union	7	0	0	0	428	21	386	19	458	22	37	2	110	5	85	4	529	26	2,039
Darby Creek	30	2	0	0	248	15	29	2	27	2	13	1	97	6	0	0	1,265	74	1,709
Dutchman Creek	26	2	0	0	172	12	0	0	14	1	0	0	37	3	67	5	1,109	78	1,426
Tough Cow	39	2	0	0	163	9	133	7	0	0	0	0	227	12	204	11	1,145	60	1,912
Upper Cow Creek Subwatershed	112	1	0	0	1,318	16	681	8	636	8	50	1	582	7	356	4	4,682	56	8,418
Hare Creek	2	0	0	0	299	24	0	0	78	6	0	0	300	24	168	14	392	32	1,238
Audie Creek	0	0	0	0	107	10	194	19	174	17	0	0	98	9	71	7	396	38	1,040
Cedar Smith	3	0	0	0	125	12	89	8	0	0	0	0	118	11	21	2	719	67	1,074
Lower Middle Creek	0	0	0	0	263	27	36	4	168	17	0	0	2	0	62	6	446	46	976
Buck Martin	4	0	0	0	655	52	17	1	111	9	0	0	120	9	0	0	364	29	1,270
Martin Creek	0	0	0	0	192	15	92	7	35	3	4	0	178	14	0	0	759	60	1,259
Lower Middle Creek Subwatershed	9	0	0	0	1,641	24	428	6	566	8	4	0	816	12	322	5	3,076	45	6,857
Gravel Brush	0	0	0	0	105	10	261	24	184	17	3	0	9	1	69	6	455	42	1,086
Upper Middle Creek	25	2	0	0	62	6	164	15	11	1	36	3	195	18	42	4	533	50	1,068
Panther Peavine	0	0	0	0	237	20	100	8	63	5	0	0	113	9	113	9	580	48	1,206
South Fork Middle Creek	18	2	0	0	251	27	55	6	49	5	22	2	102	11	51	6	370	40	917
Upper Middle Creek Subwatershed	43	1	0	0	655	15	580	14	307	7	61	1	419	10	275	6	1,938	45	4,277

	Number of Acres by Age Class and Percent of Total																		
AREA	Nonforest	%	< 5	%	10	%	20	%	30 to 40	%	50 to 70	%	80 to 110	%	120 to 190	%	200 +	%	TOTAL
Council Creek	0	0	0	0	243	23	184	17	111	10	20	2	0	0	36	3	471	44	1,065
Catching Creek	1	0	0	0	60	4	39	2	75	5	295	19	50	3	40	3	1,007	64	1,567
Russel Creek	17	1	0	0	106	6	384	20	374	20	6	0	87	5	291	15	625	33	1,889
Shoestring	0	0	0	0	139	26	1	0	4	1	0	0	40	8	31	6	317	59	533
Mitchell Creek	65	4	0	0	64	3	107	6	295	16	251	14	50	3	111	6	896	49	1,840
Russel Creek Subwatershed	83	1	0	0	612	9	715	10	859	12	572	8	227	3	509	7	3,316	48	6,894
Cow Creek Watershed Analysis Unit	1,631	4	0	0	5,773	14	3,939	9	3,421	8	920	2	3,250	8	4,184	10	19,340	46	42,450

Map 6. Cow Creek Watershed Analysis Unit
BLM Age Class Distribution

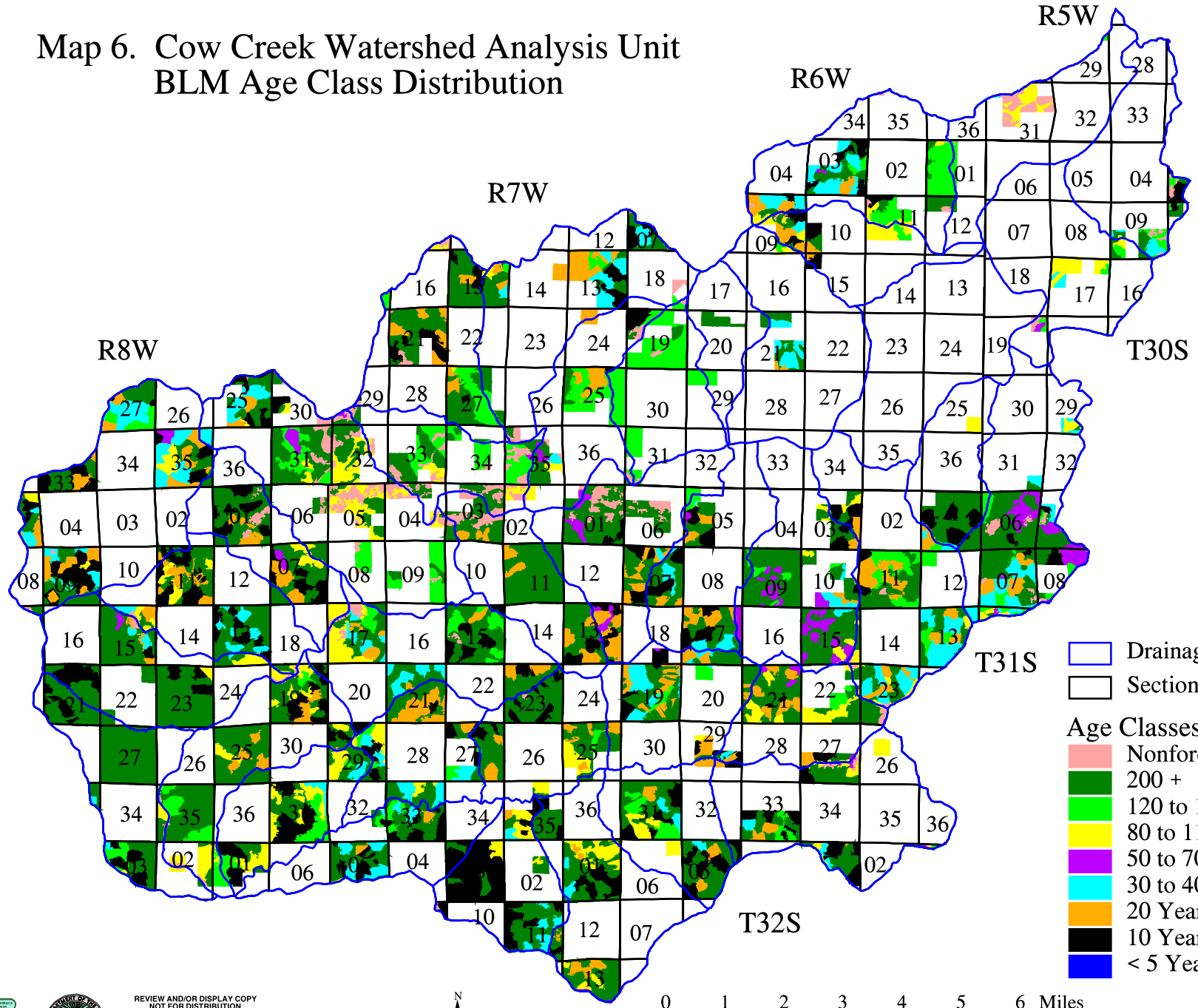


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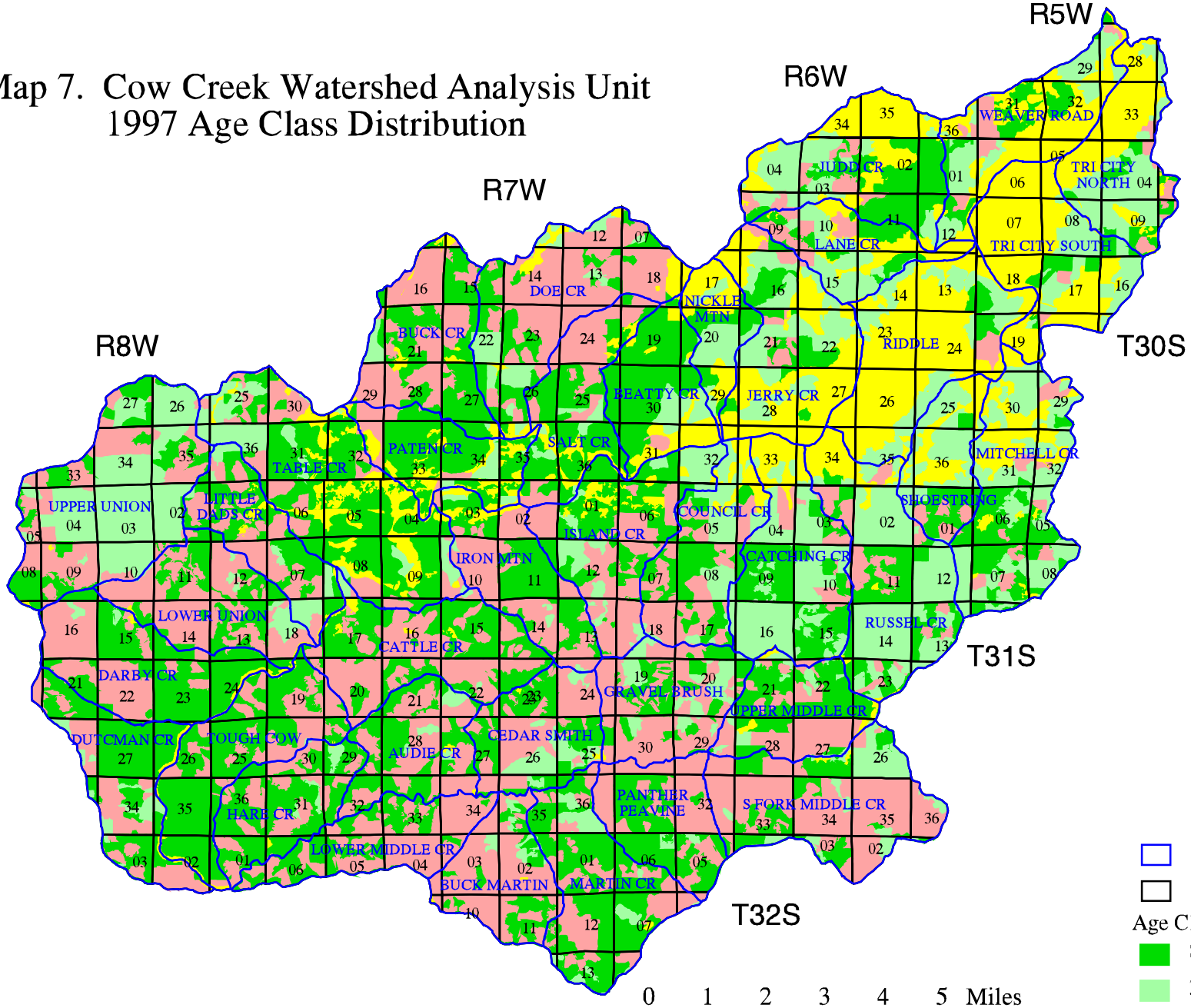
Table 4. Cow Creek Watershed Analysis Unit 1997 Age Class Distribution.

	Nonforest		Early Seral (0 to 30 Years Old)		Mid Seral (31 to 80 Years Old)		Late Seral (80 + Years Old)		
Area	Acres	%	Acres	%	Acres	%	Acres	%	Total
Jerry Creek	1,968	51	263	7	1,093	28	556	14	3,880
Judd Creek	1,272	35	314	9	942	26	1,133	31	3,661
Lane Creek	616	32	298	15	634	33	387	20	1,935
Nickle Mountain	598	45	0	0	415	32	302	23	1,315
Riddle	3,105	71	123	3	936	21	201	5	4,365
Tri City North	1,296	47	181	7	1,052	38	255	9	2,784
Tri City South	2,449	69	63	2	797	22	237	7	3,546
Weaver	1,474	48	293	10	826	27	487	16	3,080
Lane-Judd Subwatershed	12,778	52	1,535	6	6,695	27	3,558	14	24,566
Beatty Creek	452	19	58	2	263	11	1,578	67	2,351
Buck Creek	142	4	1,584	49	113	3	1,398	43	3,237
Doe Creek	378	9	2,390	57	520	12	925	22	4,213
Iron Mountain	143	5	1,331	51	71	3	1,063	41	2,608
Island Creek	209	6	1,385	39	692	19	1,285	36	3,571
Paten Creek	460	21	260	12	179	8	1,317	59	2,216
Salt Creek	241	9	914	34	169	6	1,358	51	2,682
Lower Cow Creek Subwatershed	2,025	10	7,922	38	2,007	10	8,924	43	20,878
Cattle Creek	91	2	1,900	52	40	1	1,621	44	3,652
Little Dads Creek	89	4	883	39	326	14	960	43	2,258
Table Creek	1,061	19	957	17	764	14	2,839	51	5,621
Middle Cow Creek Subwatershed	1,241	11	3,740	32	1,130	10	5,420	47	11,531
Darby Creek	69	2	1,418	42	43	1	1,834	55	3,364
Dutchman Creek	75	3	973	34	225	8	1,573	55	2,846
Lower Union	16	1	1,735	59	201	7	965	33	2,917
Tough Cow	95	3	961	29	2	0	2,261	68	3,319
Upper Union	7	0	1,575	30	2,751	52	911	17	5,244
Upper Cow Creek Subwatershed	262	1	6,662	38	3,222	18	7,544	43	17,690

Table 4. Cow Creek Watershed Analysis Unit 1997 Age Class Distribution.

	Nonforest		Early Seral (0 to 30 Years Old)		Mid Seral (31 to 80 Years Old)		Late Seral (80 + Years Old)		
Area	Acres	%	Acres	%	Acres	%	Acres	%	Total
Audie Creek	15	1	1,127	47	124	5	1,133	47	2,399
Buck Martin	7	0	1,661	73	114	5	488	21	2,270
Cedar Smith	9	0	1,161	47	390	16	897	37	2,457
Hare Creek	17	1	776	33	92	4	1,439	62	2,324
Lower Middle Creek	1	0	1,513	63	2	0	872	37	2,388
Martin Creek	6	0	1,087	31	274	8	2,115	61	3,482
Lower Middle Creek Subwatershed	55	0	7,325	48	996	7	6,944	45	15,320
Gravel Brush	4	0	1,626	59	493	18	654	24	2,777
Panther Peavine	0	0	1,220	52	49	2	1,087	46	2,356
South Fork Middle Creek	23	1	2,661	64	660	16	811	20	4,155
Upper Middle Creek	74	3	952	41	192	8	1,094	47	2,312
Upper Middle Creek Subwatershed	101	1	6,459	56	1,394	12	3,646	31	11,600
Catching Creek	431	12	348	10	1,768	49	1,091	30	3,638
Council Creek	250	9	1,007	35	716	25	883	31	2,856
Mitchell Creek	878	21	330	8	1,885	45	1,052	25	4,145
Russel Creek	478	11	601	14	2,135	50	1,035	24	4,249
Shoestring	544	29	141	8	777	42	389	21	1,851
Russel Creek Subwatershed	2,581	15	2,427	14	7,281	43	4,450	27	16,739
Cow Creek Watershed Analysis Unit	19,043	16	36,070	30	22,725	19	40,486	34	118,324

Map 7. Cow Creek Watershed Analysis Unit 1997 Age Class Distribution



0 1 2 3 4 5 Miles

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Drainage Boundaries

Section Lines

Age Classes

- 81 Years Old and Older
- 31 to 80 Years Old
- 0 to 30 Years Old
- Nonforest

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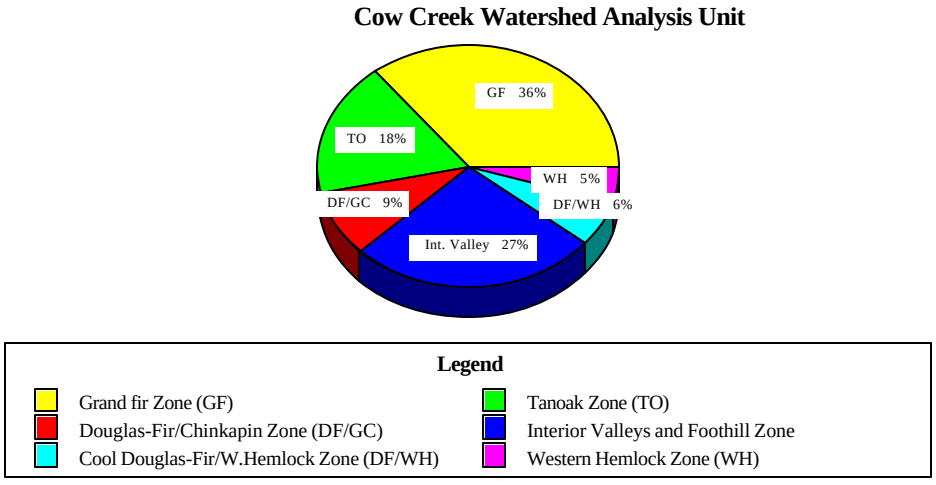
is in an area of climatic transition between the mild Willamette Valley and hot Mediterranean climate of northern California within the Klamath Mountain Physiographic Province described by Franklin and Dyrness (1984).

Vegetative zones are distinct geographical subdivisions within the broader regional delineations described by Franklin and Dryness (1984). Using vegetative zones allows a person to focus on specific geographical differences in climate or vegetation and to generalize complex local vegetation patterns. Vegetation zones may cover large geographical areas, but always have a single set of potential native plant communities repeated throughout the zone. Vegetative patterns are usually predictable within zones since they are related to local landscape features such as aspect, soil, and landform.

The array and landscape pattern of plant communities in the Cow Creek WAU was characterized from the Natural Resources Conservation Services Soil Survey report. Six vegetative zones have been identified within the Cow Creek WAU (Hickman 1994). They include the Grand fir, Tanoak, Douglas-fir/Chinkapin, Interior Valleys and Foothill, Cool Douglas-fir/Western Hemlock, and Western Hemlock Zones. The percentage of each Vegetative Classification within the Cow Creek WAU is shown in Chart 3.

Chart 3. Vegetative Classification



a. Grand Fir Zone

The Grand Fir Zone forms a transition between moist hemlock forests and the drier central valleys. This zone makes up about 36% of the land base in the central portion of the Cow Creek WAU. This area of

mountains and foothills receives 40 to 55 inches average annual precipitation. Elevation remains below about 3,200 feet.

Douglas-fir dominates the older stands with grand fir common on the northern slopes and absent or minor on the south slopes. Golden chinkapin occurs regularly on north aspects, with Pacific madrone and occasionally California black oak on south aspects. Incense cedar is often present. The area is generally too dry for western hemlock except in some drainages or on very moist north slopes. Serpentine soils present are unique and these areas do not necessarily fit the criteria for the Grand Fir Zone.

There are numerous valleys, south slopes, and foothill areas within the zone where droughty, clayey, or wet soils favor white oak savanna and restrict the development of coniferous forests. This probably explains the history of tree clearing and farming that has taken place in the past in these areas.

Understory shrubs include salal, cascade Oregongrape, western hazel, creambush oceanspray, red huckleberry, western prince's pine, whipplevine, yerba buena and hairy honeysuckle. On south slopes, grasses and Pacific poison oak become more abundant, and red huckleberry, cascade Oregongrape and salal become minor.

The portion of the Grand Fir Zone in the Cow Creek WAU resembles vegetation in Josephine and Jackson Counties and overlaps the Klamath Mountain Geologic Province. Geological differences and climatic changes result in the increasing importance of California black oak, sugar pine, ponderosa pine, canyon live oak, incense cedar, and grasses.

b. Tanoak Zone

The Tanoak Zone occurs in the southwest portion of the Cow Creek WAU and occupies about 18% of the land. This represents the northern tip of the Tanoak Zone that extends south into northern California. The average annual precipitation ranges from about 45 to 75 inches with elevations up to 3,200 feet. The Tanoak Zone appears to have a warmer climate with greater growing season moisture stress than the Grand Fir Zone.

Douglas-fir is the dominate species along with the tree form of tanoak on the north aspects and the shrub form on south aspects. It is similar to the Grand Fir Zone in species composition, except for the presence of tanoak. However, sugar pine, ponderosa pine, incense cedar, California black oak, Pacific madrone, and canyon live oak are more important here.

Shrub cover is much like that of the Grand Fir Zone except for the addition of evergreen huckleberry and scattered occurrences of Pacific rhododendron on north aspects. The competitive nature of aggressive hardwoods has important impacts on forest management. Tanoak readily sprouts after cutting or burning, along with Pacific madrone which is nearly always present.

c. Douglas-fir/Chinkapin Zone

The Douglas-fir/Chinkapin Zone occurs east of the Tanoak Zone in the southern portion of the Cow Creek WAU and occupies about 9% of the land. This represents the tip of a larger geographical area extending south into northeastern Josephine County and northwestern Jackson County. The average annual precipitation ranges from about 35 to 60 inches with elevations ranging up to 3,200 feet.

Douglas-fir is the dominant climax species on all typical upland slopes except for shallow soils, and soils with high amounts of rock fragments where Oregon white oak, canyon live oak or drought tolerant shrubs occur. On south slopes, Douglas-fir and madrone may be found with California black oak, canyon live oak, sugar pine, ponderosa pine and incense cedar. Grand fir is generally absent in the uplands but occurs frequently in the valleys, such as in the Glendale-Azalea area. This is not typical of the zone and probably represents a transition from the Grand Fir Zone.

d. Interior Valleys and Foothill Zone

The Interior Valleys and Foothill Zone occurs in the northern portion of the Cow Creek WAU and occupies approximately 27% of the land. Much of the zone is composed of hills and low mountains extending into the interior from both the Cascade Mountains and Coast Mountain Range. The average annual precipitation ranges from about 35 to 50 inches.

This zone is separated ecologically from the adjacent vegetative zones by its dry, warm climate, the high proportion of hardwoods in the uplands, and the absence of indicator species from the Grand Fir Zone. Uplands with the most favorable soils have coniferous forests, while the more droughty soils support hardwood dominated stands. Some shallow slopes support only scattered Oregon white oak and grass or shrubs such as wedgeleaf ceanothus and Pacific poison oak. Serpentine soils found here are unique and are not consistent with the criteria characterizing the zone.

Understories on bottom lands vary with soil conditions but usually contain common snowberry and Pacific poison oak. Some areas were naturally treeless meadows.

e. Cool Douglas-fir/Hemlock Zone

The Cool Douglas-fir Zone occurs at the south end of the WAU where western hemlock is absent. The Cool Hemlock Zone occurs near Silver Butte where soils support western hemlock as well as Douglas-fir. Some areas include sporadic occurrences of western redcedar, incense cedar, sugar pine, Pacific yew and/or white fir. Canyon live oak is found on soils with high amounts of rock fragments. Rhododendron, Oregon grape, salal, chinkapin, and red huckleberry occur in the understory.

This zone occupies high elevations on mountain peaks and ridges, generally above 3,000 feet. The average annual precipitation range is estimated to be between 50 and 120 inches, much of it coming in the form of snow. This zone makes up a very small percentage (about 6%) of the Cow Creek WAU.

Forest managers can expect lower tree growth rates, climatic limitations for regeneration, and severe competition from evergreen shrubs in this zone. Areas burned or with the overstory removed develop dense brush fields.

f. Western Hemlock Zone

This zone occupies a very small percentage (<5%) of the Cow Creek WAU. Elevations range up to 3,200 feet. The average annual precipitation is estimated to range from 55 to 120 inches.

Douglas-fir is the dominant species in the stand. Western hemlock is a significant understory or overstory dominant species in older stands on north aspects throughout the zone. It may be present in minor amounts on south aspects. Grand fir is often an understory or overstory component. Western redcedar and chinkapin also occur. Red alder, bigleaf maple and cascara buckthorn occur in favorable locations. Understory species include western sword fern, oxalis, vine maple, current, western hazel, creambush oceanspray, Pacific rhododendron, salal, red huckleberry, cascade Oregongrape and some evergreen huckleberry.

Forest managers may encounter a variety of competitive evergreen and deciduous shrubs in tree regeneration efforts. Red alder is especially aggressive after fires or overstory removal on many north aspects.

g. Insects and Diseases

Insects and pathogens are active in the Cow Creek WAU. Insects and diseases may cause both large and small-scale disturbances across the landscape. The magnitude of insect and disease-related disturbance is greatly influenced by tree species composition, age class, stand structure, and history of other disturbances on the same site. White pine blister rust and Port-Orford Cedar root disease are two diseases that are not native to the region. These two diseases are causing the most concern in the Cow Creek WAU, at this time.

White pine blister rust is an introduced disease caused by the fungus Cronartium ribicola. It affects all five-needle pines, including sugar pine which occurs in the Cow Creek WAU. Tree improvement programs have developed rust resistant sugar pine trees that can tolerate infection by the fungus.

Infections may predispose large trees to attack from bark beetles. Sugar pines in overstocked stands are particularly vulnerable. Mortality of large sugar pines in overstocked stands, due to fire suppression, has been observed in another part of the Resource Area. This has not been observed in the Cow Creek WAU, but is something that may occur in the future.

Port-Orford Cedar root disease is caused by the introduced fungus Phytophthora lateralis. The pathogen was first reported killing nursery stock around Seattle, Washington in 1923 and appeared in the native

range of Port-Orford Cedar (POC) in 1952. Phytophthora lateralis has spread throughout much of the range of Port-Orford Cedar in Oregon and Northern California. In virtually all cases, infection of Port-Orford Cedar by Phytophthora lateralis occurs in areas where obvious avenues for water borne spore dispersal exists. Infection is highly dependent on the presence of water in the immediate vicinity of susceptible tree roots. High risk areas for infection are stream courses, drainages, or low lying areas down slope from already present infection centers or below roads and trails where new inoculum may be introduced (Southwest Oregon Forest Insect and Disease Technical Center 1995). Port-Orford Cedar are very vulnerable to infection in concave areas that flood easily.

Humans have been the main vectors of Port-Orford Cedar root disease. Long distance spread has resulted from moving infected seedlings and especially infected soil into disease free areas. Major spread of the disease has occurred through earth movement in road construction, road maintenance, logging operations, and traffic flow on forest roads. In general, the disease has not spread into areas where physical barriers or the lack of access has prevented human activity in those areas, especially during wet periods. Soil clinging to the feet of cattle and elk has resulted in new infections in a few instances (Southwest Oregon Forest Insect and Disease Technical Center 1995).

Port-Orford Cedar regenerates profusely. The continuing supply of susceptible new seedlings on high-risk sites is likely to sustain a chronic disease source of Phytophthora lateralis, threatening trees on more favorable sites.

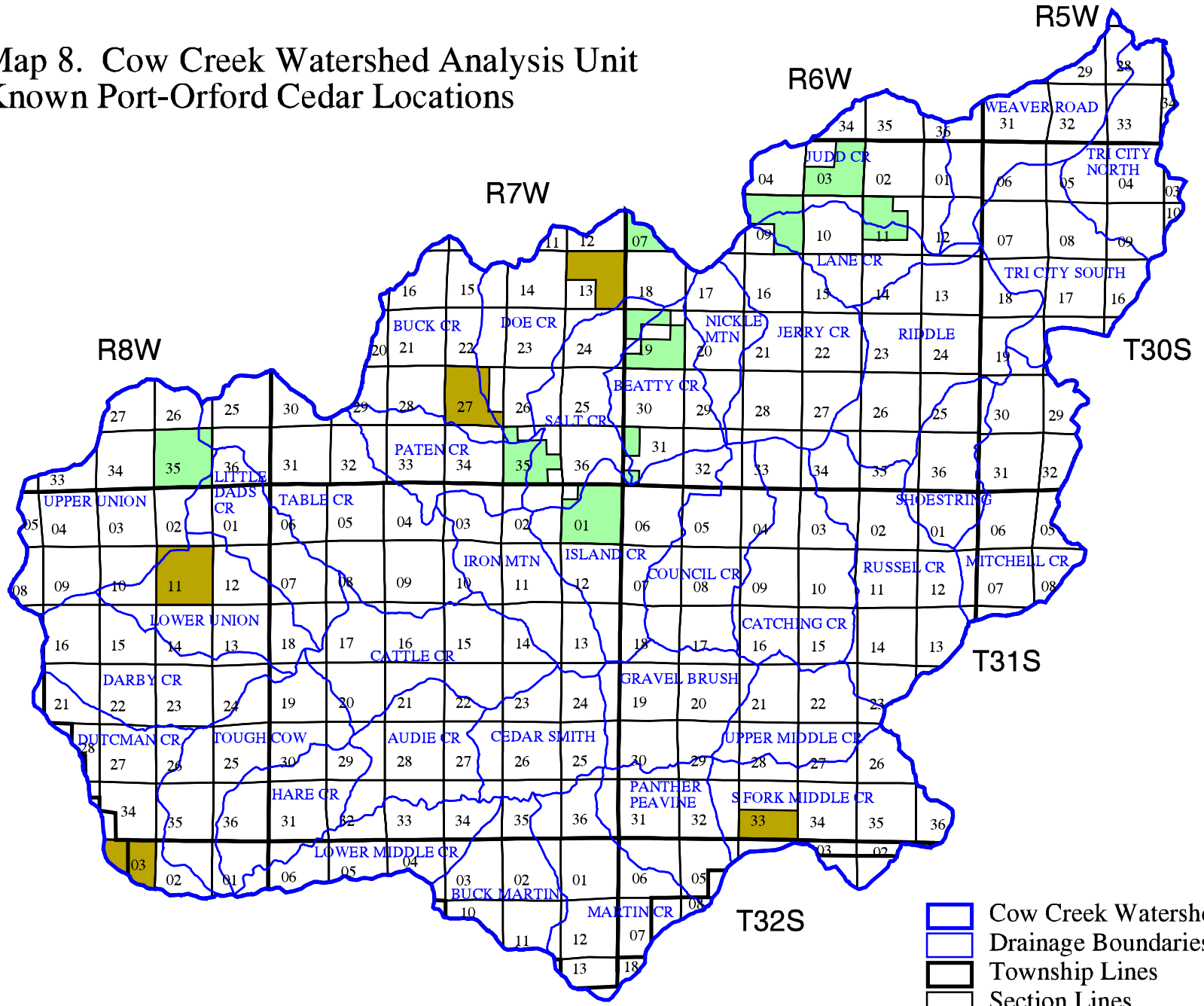
Pacific yew can serve as a host for Phytophthora lateralis. Pacific yew mortality generally occurs only in areas where there are infected Port-Orford Cedar. A Pacific yew reserve was established in the Little Dads Creek Drainage within the Cow Creek WAU. This may threaten the existence of Port-Orford Cedar in this Drainage and help spread Phytophthora lateralis.

Port-Orford Cedar occurs in mixed conifer stands within the Cow Creek WAU. Extensive roadside surveys in the South River Resource Area of the Roseburg BLM during the summer of 1996 identified where Port-Orford Cedar occurs with and without infection adjacent to roads. Sections identified from the survey having Port-Orford Cedar with or without infection are shown on Map 8 and listed in Table 5.

Port-Orford Cedar does not occur evenly over the landscape. There may be several miles between known populations. The Cow Creek WAU contains two unique disjunct subpopulations of Port-Orford Cedar. The populations in T30S, R6W, Section 9 and T31S, R6W, Section 33 are the farthest East known natural populations of Port-Orford Cedar in Oregon. Section 9 of T30S, R6W contains healthy Port-Orford Cedar. It should be managed to avoid introduction of the disease.

Port-Orford Cedar is found in the Beatty Creek Research Natural Area (RNA) in T30S, R6W, Section 31. The Beatty Creek population grows as a dominant overstory on unique, relatively dry, serpentine soils. This is strikingly different from the usual conditions Port-Orford Cedar grows, which is as a minor overstory species in riparian zone habitats. Such a population may be genetically unique from the general Port-Orford Cedar population and may contain highly desirable genotypes. An example may be a potential genetic resistance to Phytophthora lateralis.

Map 8. Cow Creek Watershed Analysis Unit
Known Port-Orford Cedar Locations



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Upstream from the RNA is another healthy population of Port-Orford Cedar in T30S, R6W, Section 19. This section is more susceptible to the introduction of Phytophthora lateralis due to the roads in the headwaters of Beatty Creek. Introduction of the disease into Section 19 would put the Port-Orford Cedar in the RNA at risk. Section 19 should be managed to avoid introduction of the pathogen. Possible mitigation may be road closures. The area could be studied for possible inclusion into the RNA.

Table 5. Known locations of Port-Orford Cedar in the Cow Creek WAU.

Location	Land Use Allocation	Natural	Planted	Healthy	Diseased
30-6-3	GFMA		X	X	
30-6-7	GFMA		X	X	
30-6-9	GFMA	X		X	
30-6-11	GFMA		X	X	
30-6-19	GFMA	X		X	
30-6-31	GFMA	X		X	
31-6-33	GFMA	X			X
30-7-13	GFMA	X			X
30-7-27	LSR	X			X
30-7-35	LSR	X		X	
30-8-35	LSR	X		X	
31-7-1	LSR	X		X	
31-8-11	LSR	X			X
32-8-3	LSR	X			X

Three sections out of six that contain Port-Orford Cedar within the LSR contain healthy POC. Young stands (less than 80 years) may be managed with silvicultural practices to prevent the spread of disease to these sections. Opportunities for treating areas with Port-Orford Cedar by density management or sanitation occur in T30S, R8W, Section 35 and T31S, R7W, Section 1.

Management guidelines to manage areas of Port-Orford Cedar root disease and prevent additional spread are listed in the Port-Orford Cedar Management Guidelines (USDI 1994a). Actions being implemented as suggested in the Port-Orford Cedar Guidelines are limiting special use permits to the time of year when the pathogen is least likely to be spread and assessing activities likely to spread the pathogen, such as road maintenance, area work projects, fire suppression activities, and silvicultural treatments, to determine methods for preventing further spread of the pathogen. Other activities include collecting cones, to use the

seed in garden studies for researching the adaptability of Port-Orford Cedar within its range and planting recently harvested areas. Field collection of vegetative material from individual trees in the Cow Creek WAU is currently underway for lab testing to screen for tree resistance to Phytophthora lateralis.

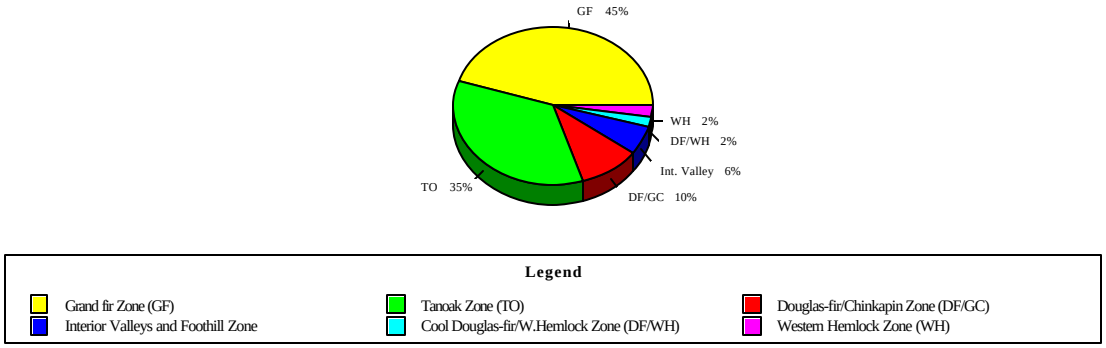
h. BLM Administered Lands

The Cow Creek WAU contains approximately 42,447 acres (36%) of BLM administered lands. Bureau of Land Management administered lands are intermingled with private lands in the "checkerboard" pattern characteristic of Revested Oregon and California (O&C) Railroad lands.

Bureau of Land Management administered lands in the Cow Creek WAU are comprised of the following vegetative zones. Approximately 45% occurs within the Grand Fir Zone, 35% in the Tanoak Zone, 10% in the Douglas-fir/Chinkapin Zone, 6% in the Interior Valleys and Foothill Zone, and 2% in the Western Hemlock Zone and Cool Douglas-fir/Hemlock Zone each (see Chart 4).

Chart 4. BLM Land Vegetative Classification

Cow Creek Watershed Analysis Unit



There are approximately 8,801 acres of GFMA with the majority of this Land Use Allocation in the Grand Fir, Douglas-fir/Chinkapin, and Interior Valley Zones. Some of the GFMA lands are in the Western Hemlock and Cool Douglas-fir/Hemlock Zones.

The LSR contains approximately 25,750 acres with the majority of the land in the Grand Fir and Tanoak Zones. A small amount of land is in the Western Hemlock and Cool Douglas-fir/Hemlock Zones and less occurs in the Interior Valley Zone.

There are approximately 7,887 acres in Connectivity with the majority of this Land Use Allocation in the Grand Fir and Western Hemlock Zones. Some of the Connectivity is in the Cool Douglas-fir/Hemlock and Interior Valley Zones with very little in the Douglas-fir/Chinkapin Zone.

Riparian Vegetation

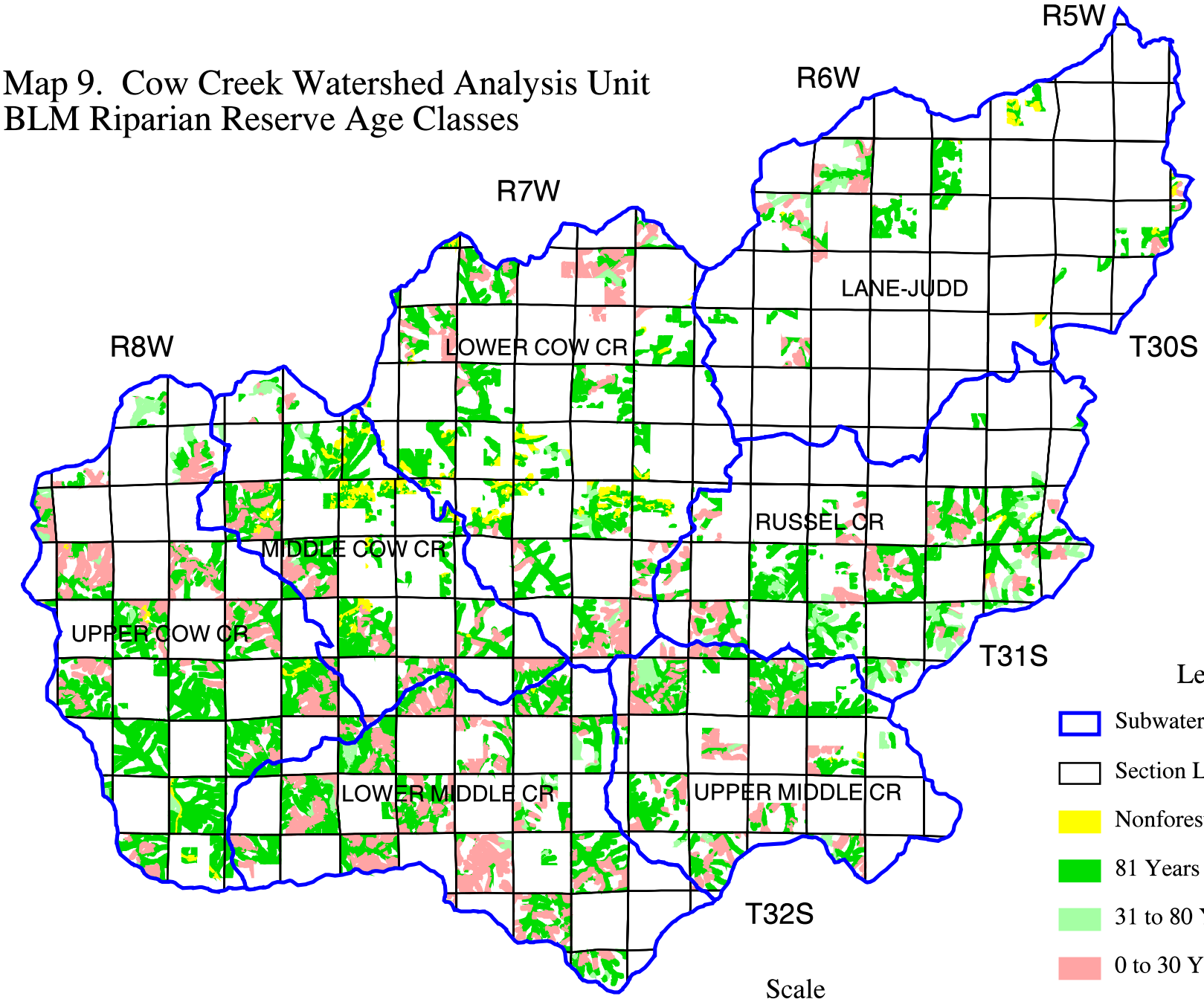
Riparian Reserves within the Cow Creek WAU and outside of the LSR account for approximately 18 percent (7,490 acres out of 42,447 acres) of the total BLM land base (see Table 6 and Map 9). Table 7 shows the age class distribution of Riparian Reserves within each Drainage. The purpose of Riparian Reserves is to "maintain and restore riparian structures and functions of intermittent streams, confer benefits to riparian-dependent and associated species other than fish, enhance conservation for organisms that are dependent on the transition zone between upslope and riparian areas, improve travel and dispersal corridors for many terrestrial animals and plants, and provide greater connectivity of the watershed" (USDA and USDI 1994b). Silvicultural treatments applied within Riparian Reserves would be to control stocking, reestablish, establish, or maintain desired vegetation characteristics to attain Aquatic Conservation Strategy objectives.

Table 6. BLM Riparian Reserve Age Class Distribution By Land Use Allocation in the Cow Creek WAU.

	Nonforest		**Early Seral** (0 to 30 Years Old)		**Mid Seral** (31 to 80 Years Old)		**Late Seral** (81 Years Old and Older)		**Total**
Land Use Allocation	Acres	%	Acres	%	Acres	%	Acres	%	Acres
GFMA	83	2	1,397	36	339	9	2,056	53	3,875
Connectivity	57	2	800	22	436	12	2,322	64	3,615
Late-Successional Reserve	664	5	4,410	31	523	4	8,634	61	14,231
Total	804	4	6,607	30	1,298	6	13,012	60	21,721

For this analysis, Riparian Reserve widths were developed using a site potential tree height of 160 feet. All intermittent streams were given a Riparian Reserve width of 160 feet on each side of the stream.

Map 9. Cow Creek Watershed Analysis Unit
BLM Riparian Reserve Age Classes



Legend

- Subwatershed Boundaries
- Section Lines
- Nonforest
- 81 Years Old and Older
- 31 to 80 Years Old
- 0 to 30 Years Old

Scale

0 1 2 3 4 5 6 7 Miles

1:154792

Table 7. Vegetation in Riparian Reserves in Cow Creek WAU.

	Nonforest		Early Seral (0 to 30 Years Old)		Mid Seral (31 to 80 Years Old)		Late Seral (80 + Years Old)		
Area	Acres	%	Acres	%	Acres	%	Acres	%	Total
Jerry Creek	0	0	60	58	0	0	44	42	104
Judd Creek	1	0	120	19	124	20	374	61	618
Lane Creek	5	3	64	33	11	6	115	59	194
Nickle Mountain	0	0	0	0	0	0	32	100	32
Riddle	3	100	0	0	0	0	0	0	3
Tri City North	20	17	35	30	4	3	59	50	117
Tri City South	13	22	0	0	3	5	42	72	58
Weaver	37	43	0	0	0	0	50	57	87
Lane-Judd Subwatershed	761	63	279	23	142	12	716	59	1,213
Beatty Creek	9	3	0	0	0	0	277	97	287
Buck Creek	22	3	182	27	0	0	466	70	670
Doe Creek	16	3	312	56	39	7	190	34	557
Iron Mountain	27	4	149	25	1	0	430	71	607
Island Creek	91	14	210	32	59	9	294	45	653
Paten Creek	114	23	1	0	1	0	379	77	495
Salt Creek	25	9	44	16	24	9	177	66	270
Lower Cow Creek Subwatershed	304	9	898	25	124	4	2,213	63	3,539
Cattle Creek	41	4	349	37	0	0	553	59	943
Little Dads Creek	42	5	318	39	14	2	442	54	815
Table Creek	215	20	28	3	79	7	741	70	1,063
Middle Cow Creek Subwatershed	298	11	695	25	93	3	1,736	62	2,821
Darby Creek	22	2	170	17	11	1	780	79	984
Dutchman Creek	26	3	124	14	28	3	687	79	865
Lower Union	9	1	340	43	0	0	449	56	798
Tough Cow	38	3	244	19	0	0	997	78	1,279
Upper Union	2	0	534	58	151	16	238	26	926
Upper Cow Creek Subwatershed	97	2	1,412	29	190	4	3,151	65	4,852

Table 7. Vegetation in Riparian Reserves in Cow Creek WAU.

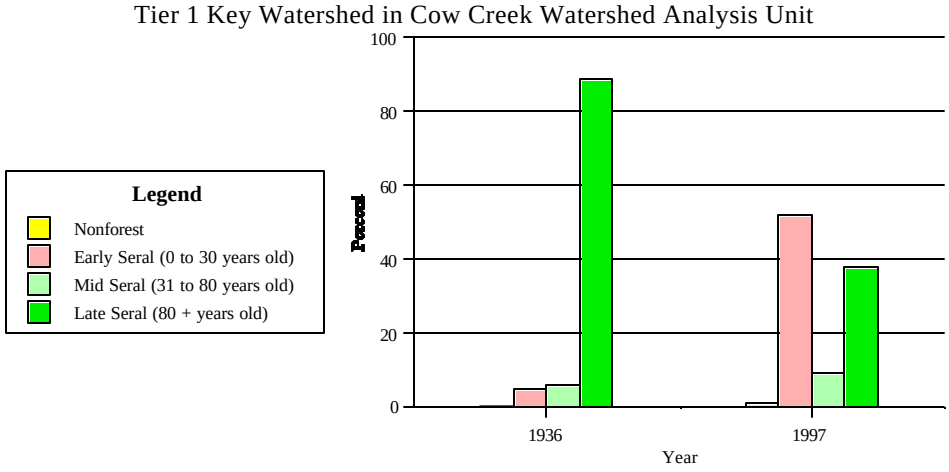
	Nonforest		Early Seral (0 to 30 Years Old)		Mid Seral (31 to 80 Years Old)		Late Seral (80 + Years Old)		
Area	Acres	%	Acres	%	Acres	%	Acres	%	Total
Audie Creek	0	0	353	51	0	0	333	49	686
Buck Martin	1	0	480	67	29	4	209	29	719
Cedar Smith	2	0	117	22	54	10	366	68	540
Hare Creek	1	0	293	32	71	8	545	60	910
Lower Middle Creek	0	0	348	51	0	0	329	49	677
Martin Creek	0	0	206	33	8	1	406	65	621
Lower Middle Creek Subwatershed	4	0	1,797	43	162	4	2,188	53	4,153
Gravel Brush	0	0	332	45	82	11	323	44	737
Panther Peavine	0	0	195	34	19	3	361	63	574
South Fork Middle Creek	8	2	156	39	40	10	194	49	398
Upper Middle Creek	0	0	141	24	31	5	417	71	589
Upper Middle Creek Subwatershed	8	0	824	36	172	7	1,295	56	2,298
Catching Creek	0	0	81	12	118	17	493	71	692
Council Creek	0	0	211	51	11	3	193	47	415
Mitchell Creek	13	2	101	15	144	22	407	61	665
Russel Creek	0	0	211	27	141	18	430	55	782
Shoestring	0	0	98	34	2	1	188	66	287
Russel Creek Subwatershed	13	0	702	25	416	15	1,711	60	2,841
Cow Creek Watershed Analysis Unit	1,485	7	6,607	30	1,299	6	13,010	60	21,717

Perennial streams were given a Riparian Reserve width of 320 feet (2 times the site potential tree height) on each side of the stream. Actual projects would use site specific information for determining if a stream needed a Riparian Reserve width of 160 feet or 320 feet.

Riparian Reserve widths may be adjusted following watershed analysis, a site specific analysis, and describing the rationale for the adjustment through the appropriate NEPA decision making process (USDI 1995). Critical hillslope, riparian, channel processes and features, and the contribution of Riparian Reserves to benefit aquatic and terrestrial species would be the basis for the analysis. At a minimum, a fisheries biologist, soil scientist, hydrologist, botanist, and wildlife biologist should conduct the analysis for adjusting Riparian Reserve widths.

Middle Creek, within the Cow Creek Watershed Analysis Unit, was designated a Tier 1 Key Watershed. Tier 1 Key Watersheds were designed to contribute directly to conservation of at-risk anadromous salmonids and resident fish species. The structural classes in the Middle Creek Riparian Reserves have changed since 1936 when a small amount of acreage was in the Early Seral Stage to the present (1997) when approximately half of the acres are in the Early Seral Stage (see Chart 5).

Chart 5. Middle Creek Riparian Reserves



i. Private Lands

Private lands account for approximately 64% (75,882 acres) of the Cow Creek WAU (see Table 8 and Map 10). Private ownership located in the interior valleys of Cow Creek and the South Umpqua River consists mainly of agricultural lands (11,107 acres). The rest of the private lands are mainly forested lands intermingled with BLM administered lands. Approximately 47 percent of the private lands have been harvested within the past 40 years.

Table 8. Acres by Age Class on Private Lands.

	Number of Acres by Age Class and Percent of Total																		
AREA	Nonforest	%	< 5	%	10	%	20	%	30 to 40	%	50 to 70	%	80 to 110	%	120 to 190	%	200 +	%	TOTAL
Weaver Road	1,350	48	0	0	0	0	228	8	469	17	421	15	284	10	34	1	25	1	2,811
Tri City North	1,263	50	0	0	85	3	0	0	483	19	515	21	162	6	0	0	0	0	2,508
Tri City South	2,435	74	0	0	0	0	26	1	454	14	347	11	23	1	0	0	0	0	3,285
Judd Creek	1,251	52	0	0	0	0	0	0	666	27	47	2	67	3	335	14	61	3	2,426
Lane Creek	610	41	0	0	0	0	17	1	453	30	238	16	19	1	151	10	0	0	1,489
Riddle	3,102	71	0	0	0	0	0	0	463	11	596	14	200	5	0	0	0	0	4,362
Jerry Creek	1,968	54	0	0	0	0	74	2	618	17	449	12	300	8	210	6	0	0	3,618
Nickle Mountain	597	49	0	0	0	0	0	0	75	6	311	26	44	4	182	15	0	0	1,208
Lane-Judd Subwatershed	12,576	58	0	0	85	0	345	2	3,681	17	2,924	13	1,099	5	912	4	86	0	21,707
Beatty Creek	438	26	0	0	0	0	0	0	56	3	13	1	250	15	895	54	1	0	1,653
Doe Creek	331	10	0	0	703	22	942	30	506	16	173	5	0	0	128	4	379	12	3,163
Salt Creek	194	10	0	0	175	9	517	27	79	4	73	4	81	4	568	29	253	13	1,940
Island Creek	55	3	0	0	51	2	769	36	156	7	561	26	81	4	370	17	80	4	2,124
Buck Creek	97	5	0	0	849	46	379	20	4	0	109	6	44	2	19	1	359	19	1,861
Paten Creek	184	16	0	0	130	11	53	5	188	16	34	3	82	7	215	19	262	23	1,148
Iron Mountain	50	4	0	0	491	38	575	45	8	1	20	2	51	4	4	0	85	7	1,284
Lower Cow Creek Subwatershed	1,349	10	0	0	2,399	18	3,235	25	997	8	983	7	589	4	2,199	17	1,419	11	13,173
Table Creek	673	21	0	0	741	24	24	1	405	13	102	3	229	7	514	16	455	14	3,142
Little Dads Creek	33	3	0	0	276	26	184	17	160	15	139	13	95	9	1	0	170	16	1,059
Cattle Creek	29	2	21	1	581	31	735	39	73	4	4	0	121	6	86	5	247	13	1,896
Middle Cow Creek Subwatershed	735	12	21	0	1,598	26	943	15	638	10	245	4	445	7	601	10	872	14	6,097

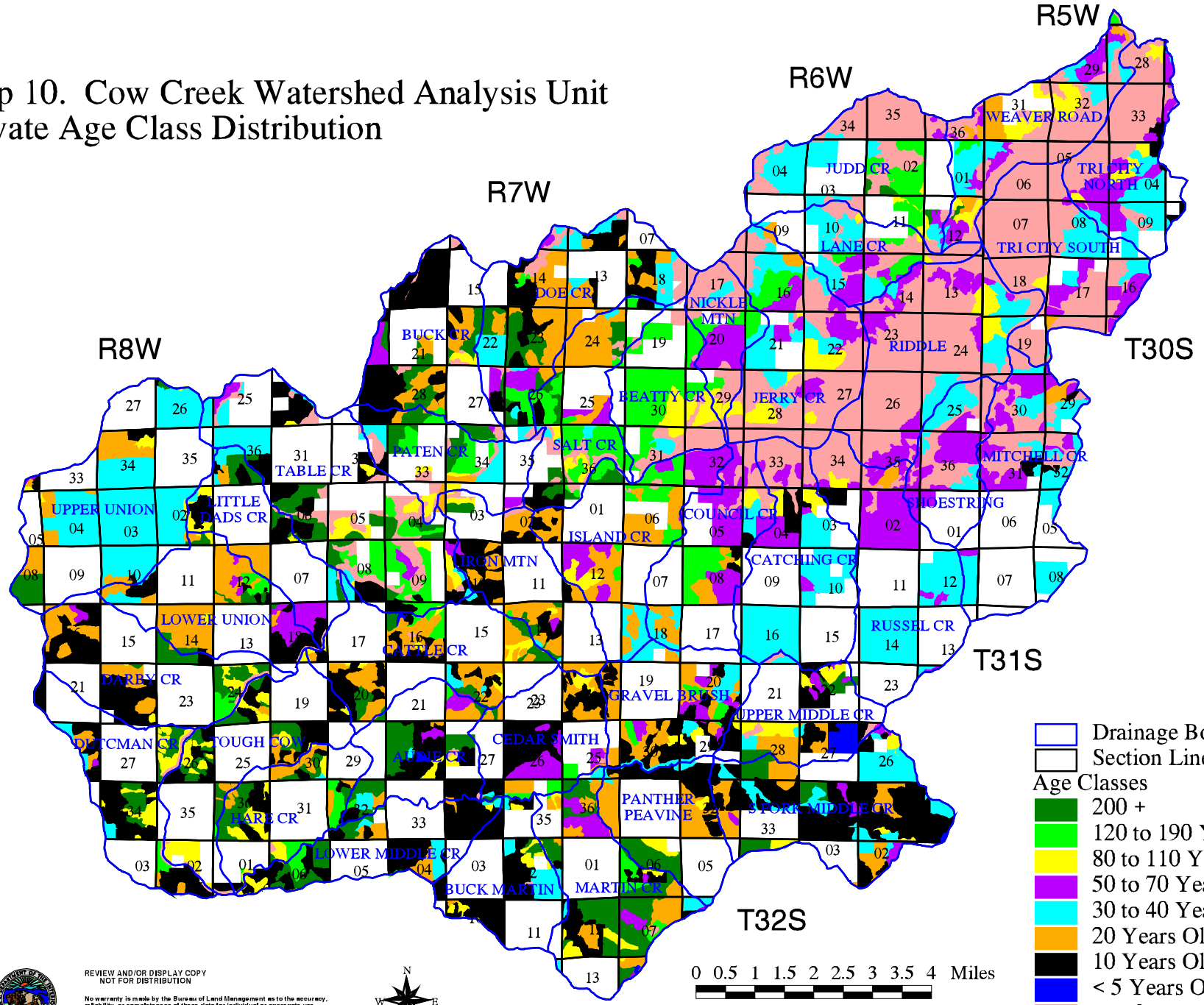
Table 8. Acres by Age Class on Private Lands.

	Number of Acres by Age Class and Percent of Total																		
AREA	Nonforest	%	< 5	%	10	%	20	%	30 to 40	%	50 to 70	%	80 to 110	%	120 to 190	%	200 +	%	TOTAL
Lower Union	6	0	0	0	294	19	814	51	70	4	181	11	35	2	85	5	101	6	1,586
Upper Union	0	0	0	0	82	3	492	15	2,392	75	6	0	58	2	0	0	176	5	3,206
Darby Creek	39	2	0	0	764	46	349	21	0	0	30	2	106	6	67	4	299	18	1,655
Dutchman Creek	49	3	0	0	719	51	82	6	80	6	4	0	197	14	52	4	239	17	1,422
Tough Cow	55	4	0	0	561	40	104	7	0	0	0	0	327	23	6	0	355	25	1,406
Upper Cow Creek Subwatershed	149	2	0	0	2,420	26	1,841	20	2,542	27	221	2	723	8	210	2	1,170	13	9,275
Hare Creek	15	1	0	0	223	21	171	16	5	0	0	0	190	18	174	16	306	28	1,084
Audie Creek	15	1	12	1	495	36	106	8	44	3	103	8	59	4	30	2	495	36	1,359
Cedar Smith	6	0	0	0	669	48	271	20	8	1	236	17	44	3	97	7	53	4	1,384
Lower Middle Creek	0	0	0	0	771	55	138	10	138	10	2	0	51	4	64	5	248	18	1,411
Buck Martin	3	0	0	0	663	66	12	1	206	21	0	0	71	7	6	1	41	4	1,001
Martin Creek	5	0	7	0	272	12	395	18	106	5	225	10	129	6	164	7	919	41	2,223
Lower Middle Creek Subwatershed	44	1	19	0	3,093	37	1,093	13	507	6	566	7	544	6	535	6	2,062	24	8,462
Gravel Brush	4	0	0	0	505	30	623	37	282	17	156	9	31	2	90	5	0	0	1,690
Upper Middle Creek	49	4	143	12	326	26	238	19	86	7	50	4	247	20	0	0	103	8	1,243
Panther Peavine	0	0	0	0	341	30	421	37	81	7	1	0	68	6	0	0	238	21	1,151
South Fork Middle Creek	5	0	9	0	1,513	47	508	16	687	21	133	4	90	3	0	0	294	9	3,239
Upper Middle Creek Subwatershed	58	1	152	2	2,685	37	1,790	24	1,136	16	340	5	436	6	90	1	635	9	7,323

Table 8. Acres by Age Class on Private Lands.

	Number of Acres by Age Class and Percent of Total																		
AREA	Nonforest	%	< 5	%	10	%	20	%	30 to 40	%	50 to 70	%	80 to 110	%	120 to 190	%	200 +	%	TOTAL
Council Creek	250	14	0	0	66	4	213	12	229	13	645	36	67	4	319	18	0	0	1,789
Catching Creek	430	21	0	0	174	8	0	0	1,082	52	278	13	107	5	0	0	0	0	2,071
Russel Creek	462	20	0	0	68	3	43	2	1,036	44	711	30	33	1	0	0	9	0	2,362
Shoestring	544	41	0	0	0	0	0	0	288	22	486	37	0	0	0	0	0	0	1,317
Mitchell Creek	813	35	0	0	71	3	71	3	789	34	562	24	0	0	0	0	0	0	2,306
Russel Creek Subwatershed	2,499	25	0	0	379	4	327	3	3,424	35	2,682	27	207	2	319	3	9	0	9,845
Cow Creek Watershed Analysis Unit	17,410	23	192	0	12,659	17	9,574	13	12,925	17	7,961	10	4,043	5	4,866	6	6,253	8	75,882

Map 10. Cow Creek Watershed Analysis Unit
Private Age Class Distribution



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C. Geology, Soils, and Erosion Processes

1. Geology

Most of the Cow Creek WAU is comprised of volcanic and sedimentary rocks within the Klamath Mountains. There is an area (about 1% of the WAU) of intrusive rocks along the eastern portion of the WAU that is dioritic and granitoid. The Klamath Mountains have produced complex mineralogy and are conducive to mining activities. A portion of this WAU (less than 5%) is located within the Coast Range. This area in the Coast Range is in the northwestern portion of the WAU.

The Cow Creek WAU contains the oldest formations (Mesozoic and Jurassic age) in Douglas County. The southern part of the WAU is composed of one sedimentary rock formation (KJds), while the geology in the north half is very diverse. Cow Creek appears to have been formed through large faults, uplifting processes, and earth movement that dictated tributary water flow. Contact zones between geologic formations can exhibit excess surface and groundwater delivery and cause earth flows. The Cow Creek WAU is characterized by deeply weathered sandstone creating steep canyons with slopes averaging approximately 60%. The geology has contributed to current water quality, soil types and low summer flow conditions in the WAU.

Following is a listing of the geologic types located within this WAU and a short description of each type. Geology type locations are shown in Map 11. The Geologic Map of Oregon by George W. Walker and Norman S. MacLeod (1991); and the Geologic Compilation Map of Douglas County, Oregon by J. D. Beaulieu and Len Ramp (1972) are the main sources of information for the geology section.

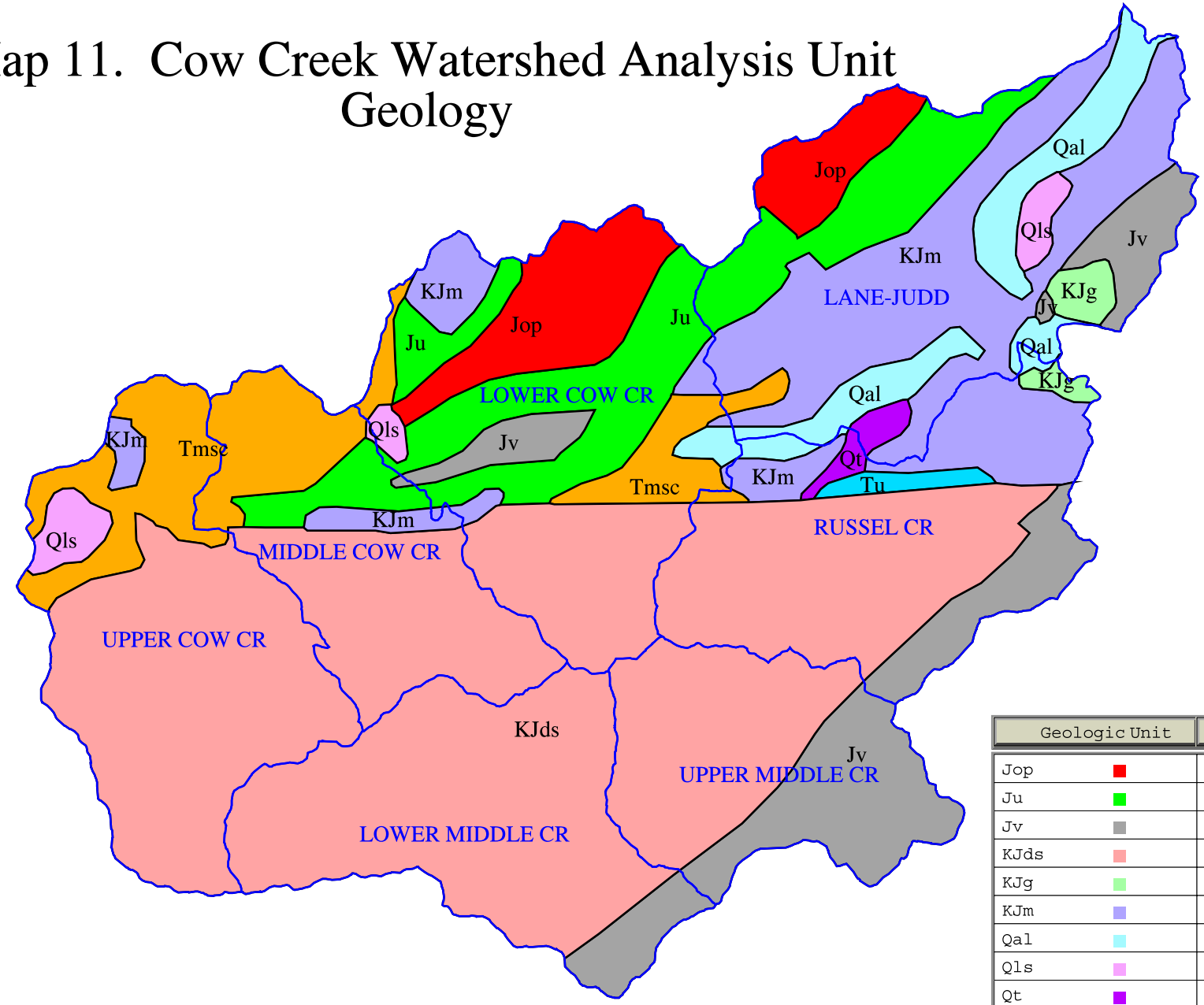
Jop - 6,303 acres
Otter Point Formation of Dott (1971) and related rocks (Upper Jurassic) - Highly sheared graywacke, mudstone, siltstone, and shale with lenses and pods of sheared greenstone, limestone, chert, blueschist, and serpentine.

Ju - 11,833 acres
Ultramafic and related rocks of ophiolite sequences (Jurassic) - Predominantly harzburgite and dunite with both cumulate and tectonite fabrics. Locally altered to serpentinite. Includes gabbroic rocks and sheeted diabasic dike complexes.

Jv - 11,360 acres
Volcanic rocks (Jurassic) - Lava flows, flow breccia, and agglomerate dominantly of plagioclase, pyroxene, and hornblende porphyritic and aphyric andesite. Includes flow rocks that range in composition from basalt to rhyolite as well as some interlayered tuff and tuffaceous sedimentary rocks. Commonly metamorphosed to greenschist facies; locally foliated, schistose or gneissic.

KJds - 54,447 acres
Sedimentary rocks - Sandstone, conglomerate, graywacke, rhythmically banded chert lenses.

Map 11. Cow Creek Watershed Analysis Unit Geology



Geologic Unit	Acres
Jop	6303.14
Ju	11833.28
Jv	11359.93
KJds	54446.56
KJg	918.45
KJm	16917.95
Qal	4689.70
Qls	1676.97
Qt	632.65
Tmsc	8993.57
Tu	567.61
Total	118339.81

KJg - 918 acres
Granitic rocks (Cretaceous and Jurassic) - Mostly tonalite and quartz diorite but including lesser amounts of other granitoid rocks.

Kjm - 16,918 acres
Myrtle Group (Lower Cretaceous and Upper Jurassic) - Conglomerate sandstone, siltstone, and limestone. Locally fossiliferous.

Qal - 4,690 acres
Alluvial deposits (Holocene) - Sand, gravel, and silt forming flood plains and filling channels of present streams. In places includes talus and slope wash.

Qls - 1,677 acres
Landslide and debris-flow deposits (Holocene and Pleistocene) - Unstratified mixtures of fragments of adjacent bedrock. Locally includes slope wash and colluvium.

Qt - 633 acres
Terrace, pediment, and lag gravels (Holocene and Pleistocene) - Unconsolidated deposits of gravel, cobbles, and boulders intermixed and locally interlayered with clay, silt, and sand. Mostly on terraces and pediments above present flood plains.

Tmsc - 8,994 acres
Marine siltstone, sandstone, and conglomerate (lower Eocene) - Cobble and pebble conglomerate, pebbly sandstone, lithic sandstone, siltstone, and mudstone; massive to thin bedded; shelf and slope depositional setting.

Tu - 568 acres
Undifferentiated tuffaceous sedimentary rocks, tuffs, and basalt (Miocene and Oligocene) - Heterogeneous assemblage of continental, largely volcanogenic deposits of basalt and basaltic andesite, including flows and breccia, complexly interstratified with epiclastic and volcaniclastic deposits of basaltic to rhyodacitic composition.

2. Soils

The National Cooperative Soil Survey (NCSS) conducted by the Natural Resources Conservation Service (NRCS) and the Timber Production Capability Classification (TPCC) conducted by the Bureau of Land Management are the main sources of information for the soils section. The Timber Production Capability Classification (TPCC) conducted by the Bureau of Land Management is the main source of information for the Landslides section.

Soils in this WAU have developed dominantly from sedimentary and volcanic parent material within the Klamath Mountains. About 1% of the WAU has soils developed from marine sediments within the Coast Range.

The main soils related properties significant to planning and analysis for this WAU are: serpentine soils, granitic soils, nonsuitable woodlands due to low soil moisture, landscape segments that commonly exhibit

riparian/wetland characteristics (potentially wet), floodplain soils, and hydric soils (see Map 12). There are 8,910 acres of serpentine soils mapped in this WAU. Serpentine soils generally have high amounts of magnesium and iron and low amounts of nitrogen, phosphorous, potassium, and molybdenum. Productivity for Douglas-fir is poor and grasses grow at a rapid rate. Serpentine soils are mostly located in the northern one third of the WAU.

There are 1,250 acres of granitic soils mapped in this WAU. Granitic soils are highly susceptible to surface erosion and shallow slope failure, have a low organic carbon reserve, and are not very resilient. Most of the granitic soils are in the southeast corner of the Lane-Judd Subwatershed.
There are 2,425 acres of nonsuitable woodlands due to low soil moisture in the Cow Creek WAU. These are areas where the soil's water holding capacity is too low to allow productive tree growth. These soils have less than one inch of available water holding capacity in the top twelve inches of soil. These nonsuitable woodlands are scattered, with the largest concentration in the Upper Cow Creek Subwatershed.

Hydric soil areas too small for mapping (NCSS standards <5 acres) exist as minor components within mapping units that have been labeled 'potentially wet'. There are 2,520 acres of 'potentially wet' soils in this WAU. These mapping units have watertables within 18 inches of the surface in draws and concavities encompassing about 35% of the unit. These 'potentially wet' soils occur scattered throughout the WAU with few occurrences in the Upper Cow Creek and Lower Middle Creek Subwatersheds. It is anticipated that less than 20% of the 2,520 acres will classify as hydric soils. Most of these hydric inclusions will usually be less than one acre in size.
There are 2,470 acres of floodplain soils in this WAU. These occur mostly in the Lane-Judd Subwatershed and mainly on private lands.

There are 1,200 acres of hydric soils in this WAU. Hydric soils generally have a watertable within 10 inches of the soil surface for at least 5% of the growing season. Most mapped units of hydric soils occur in the Lane-Judd Subwatershed.

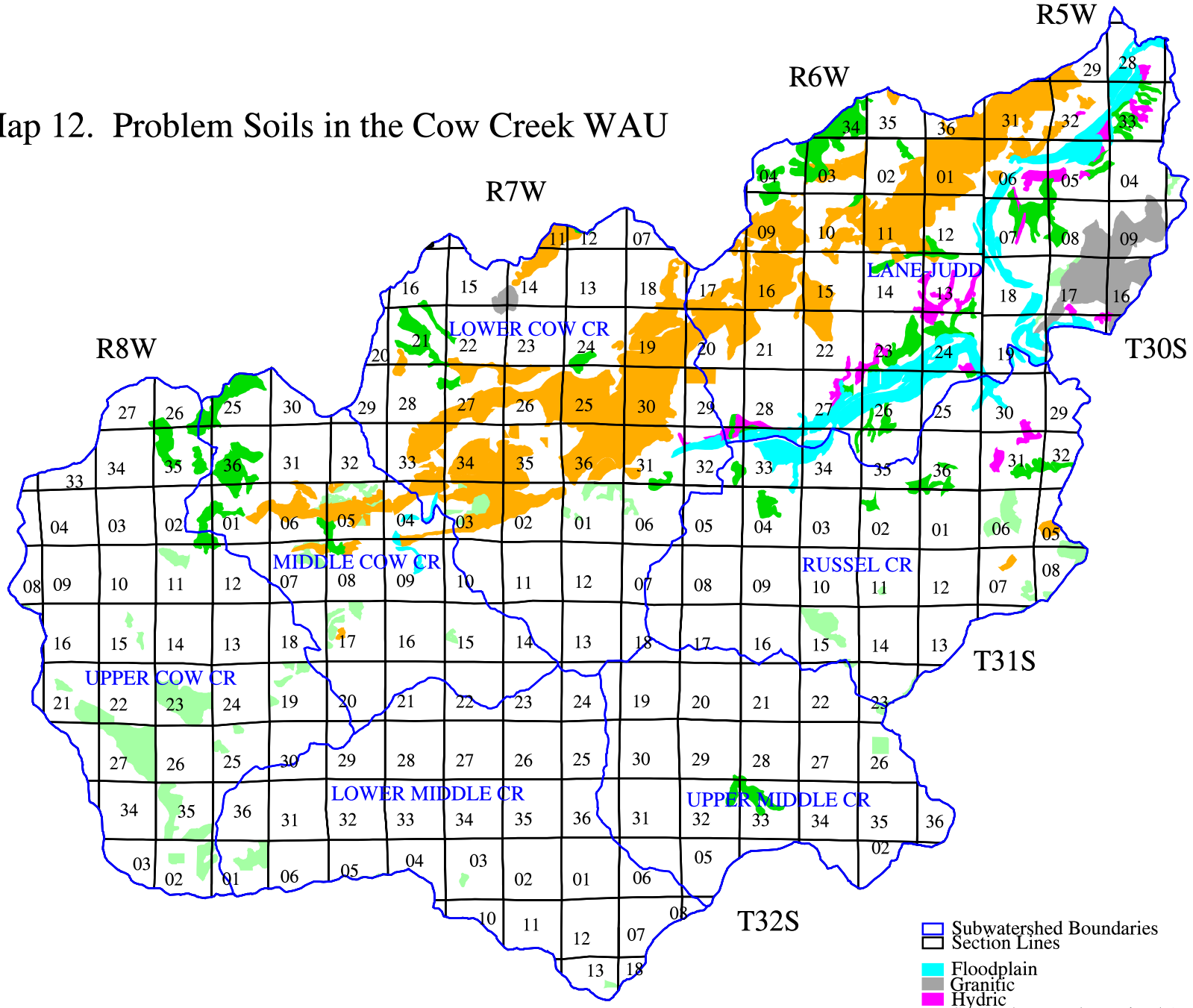
3. Landslides

A major process that can affect water quality, erosion, and sedimentation is the occurrence of landslides. Landslides can occur naturally or can be triggered by human activities such as road building or logging. The Cow Creek WAU landslide potential map (Map 13) indicates problem areas of slope instability.

The **translational slide areas** (shown in red) are generally on steep slopes (60% to 100% plus) where debris type landslides exist. These areas have a high potential for debris type landslides and are not suitable for forest management activities.

The areas classified as **fragile: debris type landslide potential** (shown in gray) are characterized by slopes commonly ranging from 60% to 100% plus. Unacceptable soil and organic matter losses are expected to occur as a result of forest management activities unless mitigating measures (see Best

Map 12. Problem Soils in the Cow Creek WAU



Subwatershed Boundaries
Section Lines

Floodplain
Granitic
Hydric
Somewhat Poorly Drained (Potentially Wet)
Serpentine soils
Nonsuitable Woodlands due to Low Soil Moisture

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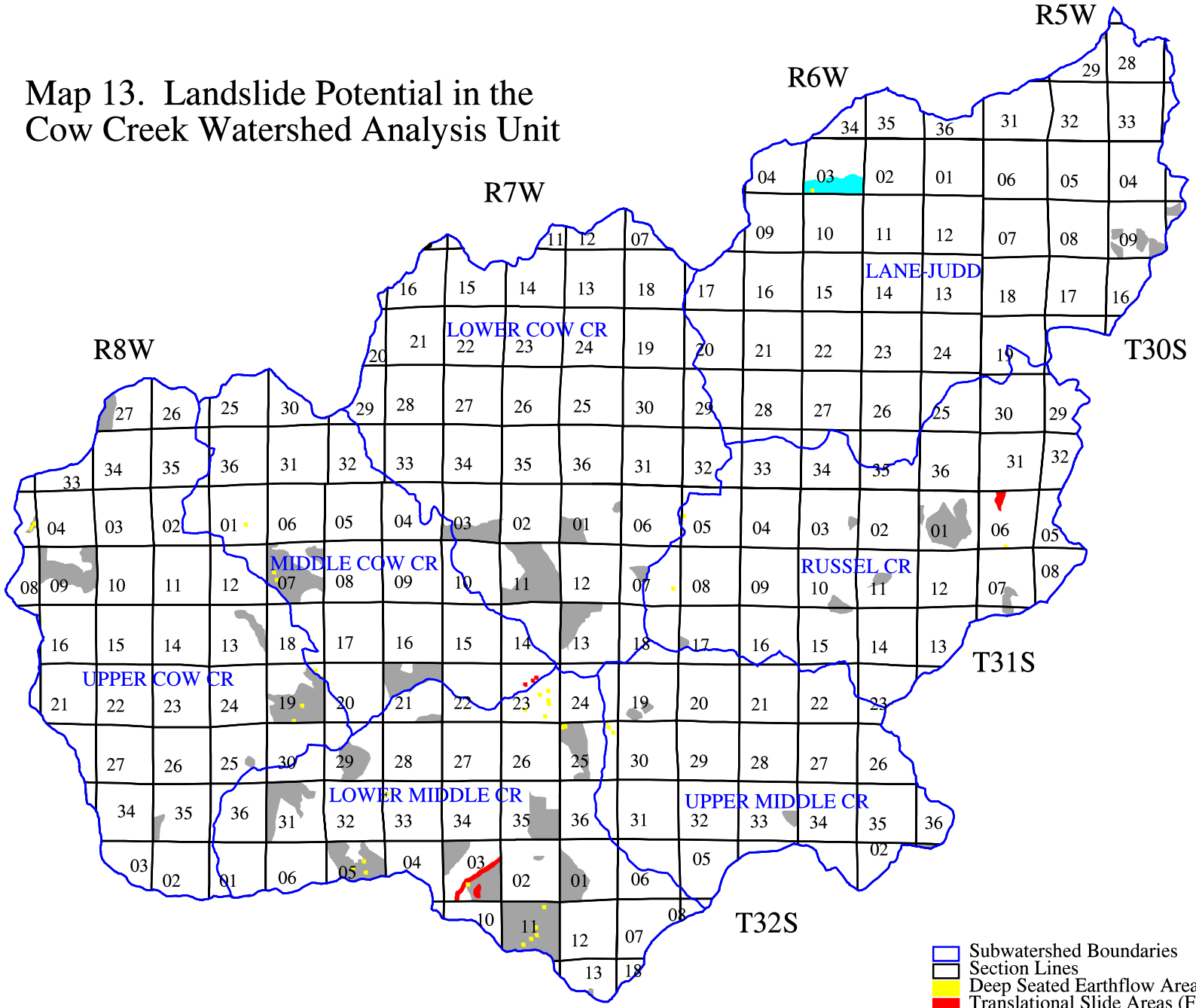
N W E S

0 0.5 1 1.5 2 2.5 3 3.5 Miles

1:153865

Map 13. Landslide Potential in the Cow Creek Watershed Analysis Unit



N W E S

0 0.5 1 1.5 2 2.5 3 3.5 Miles

1:155012

Management Practices, Appendix D, Roseburg District Resource Management Plan, USDI 1995) are followed to protect the soil/site productivity.

The **deep seated earthflow areas** (shown in yellow) are characterized by undulating topography and slopes less than 60%. These deep-seated slump-earthflows are active and not suited for forest management activities.

The areas classified as **fragile: mass movement potential** (shown in blue) are characterized by undulating topography generally on less than 60% slopes where soil tension cracks and sag ponds may exist. Because of the slow rate of movement, forest management is feasible, when combined with Best Management Practices (BMPs).

D. Hydrology

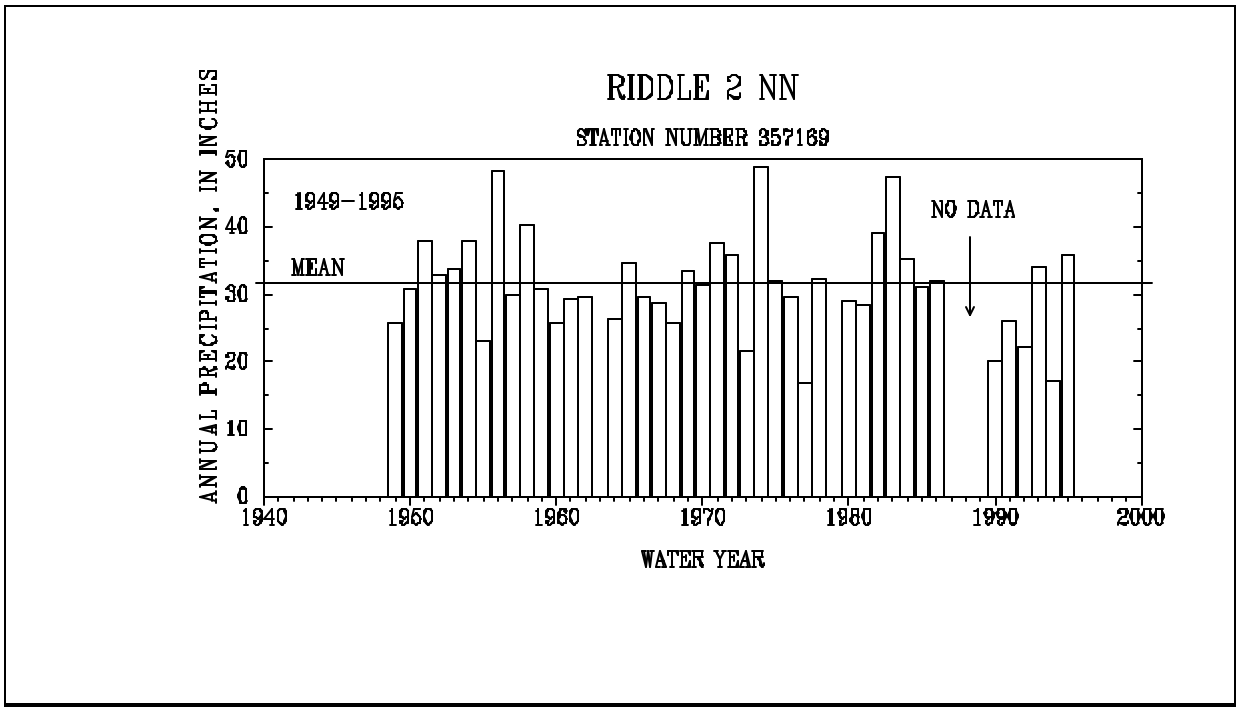
The Cow Creek Watershed Analysis Unit is 118,340 acres (185 square miles) in size with 1,284 miles of streams and 981 miles of roads. Road densities range from 4.45 miles per square mile in the Middle Cow Creek subwatershed to 6.15 miles per square mile in the Upper Middle Creek subwatershed. Stream densities range from 4.01 miles per square mile in the Lane-Judd subwatershed to 9.05 miles per square mile in the Lower Middle Creek subwatershed.

Cow Creek joins the South Umpqua River at river mile 158.9 from the mouth of the Umpqua River. Middle Creek is a major tributary of Cow Creek intersecting it at 26.9 miles.

1. Climate

The average annual precipitation measured at the National Oceanic and Atmospheric Administration (NOAA) weather station at Riddle is approximately 32 inches (see Chart 6). The annual watershed runoff is 26 inches. The average annual flow and average minimum flow of Cow Creek is 345 cubic feet per second (cfs) and 59 cfs respectively (USDI 1994b). Monthly precipitation and temperature data at Riddle are shown in Charts 7 and 8. Most of the precipitation and runoff occurs from October to April. On the average, only three inches of precipitation falls during the summer months.

Chart 6. Annual Precipitation Data at Riddle From 1949 to 1995.



The area has a Mediterranean type climate, characterized by cool, wet winters and hot, dry summers. The average maximum air temperature is 65.8 degrees Fahrenheit (F), while the average temperature during

Chart 7. Average Monthly Precipitation at Riddle.

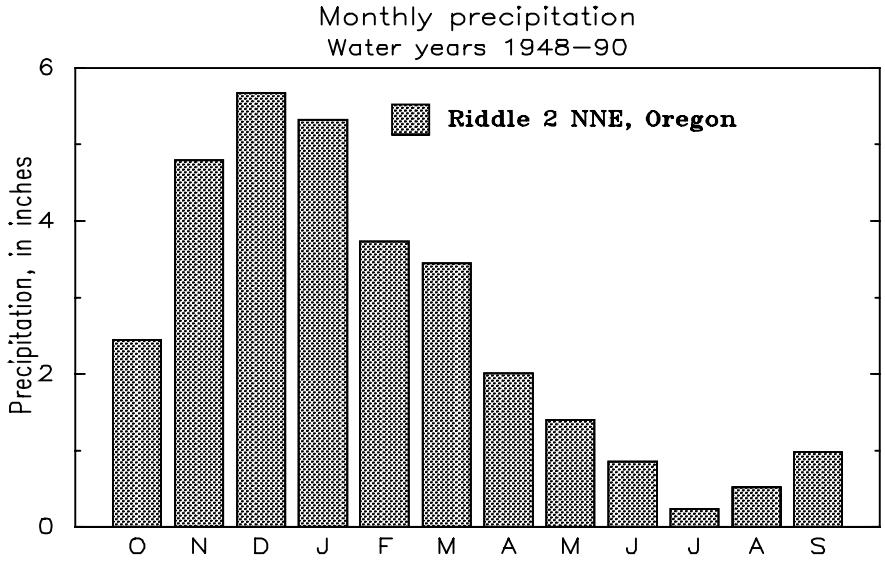
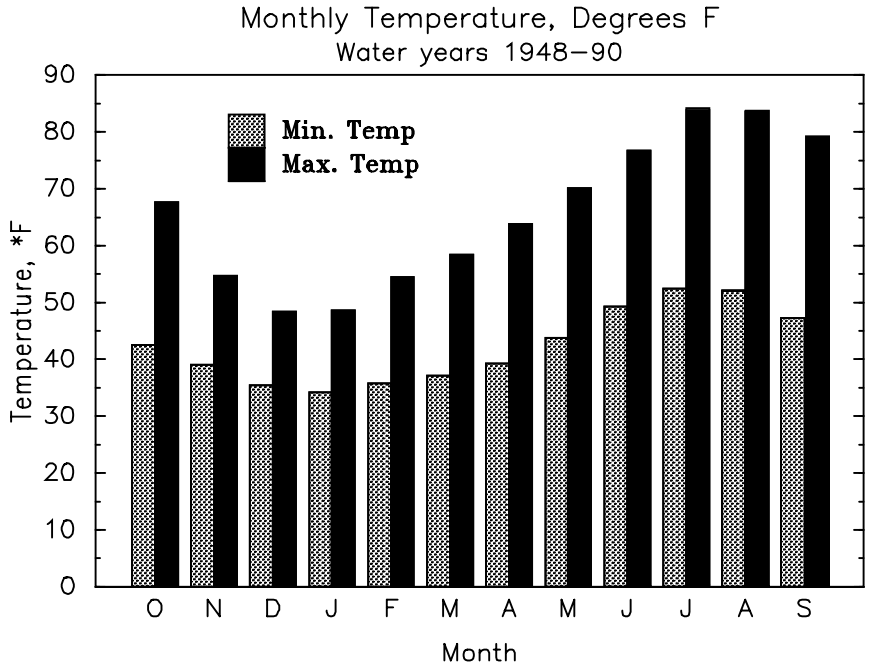


Chart 8. Average Minimum and Maximum Monthly Temperature at Riddle.



the summer months is 79 degrees Fahrenheit. The combination of dry summers, minimal snowpack, low yield headwater aquifers, and surface water withdrawals for irrigation can result in extremely low flow conditions in Cow Creek (Rinella 1986).

2. Municipal Watersheds

The City of Riddle takes water from lower Cow Creek and Russel Creek. The city of Glendale draws water from Cow Creek as a tertiary source when the two other sources dry up. Glendale is upstream from the WAU, so activities in the WAU would not affect water quality of Cow Creek for use by Glendale. However, when Glendale uses Cow Creek as a water source the amount of water flowing through the WAU in Cow Creek would probably decrease.

Groundwater yield in most areas of the WAU is limited, but generally is of good quality. The alluvium of Cow Creek is the best water yield area, but the real extent and saturated thickness of these deposits are too small to make them an important source of groundwater supply. The alluvial deposits could yield as much as 50 to 100 gallons per minute, while the older Jurassic volcanic rocks yield less than 5 gallons per minute.

3. Water Quality

The Oregon Department of Environmental Quality Administrative Rules Antidegredation Policy is designed to protect, maintain, and enhance surface water quality from point and nonpoint sources of pollution and to protect all existing beneficial uses. The identified Beneficial Uses of surface waters in the Umpqua Basin include public and private domestic and industrial water supplies, livestock watering, irrigation, salmonid fish rearing, anadromous fish passage, resident fish, aquatic life, salmonid fish spawning, fishing, wildlife, hunting, water contact recreation, boating, hydroelectric power, and aesthetic quality.

Section 303(d) of the 1972 Federal Clean Water Act (CWA) requires each state, every two years, to identify water bodies that do not meet surface water quality standards. Cow Creek, the South Fork of Middle Creek, and the main stem of Middle Creek do not meet the Umpqua Basin temperature standard of 64 degrees Fahrenheit, established by the state and the Environmental Protection Agency (EPA). Cow Creek is also water quality limited due to dissolved oxygen (DO) and pH levels that do not meet state standards.

Water quality data taken in Cow Creek near Riddle, Oregon from 1990 to 1992 found pH, dissolved oxygen (DO), and temperature did not meet state water quality standards. Dissolved oxygen and pH measurements taken in the morning were within state standards. However, afternoon pH measurements exceeded 8.5 and DO readings were less than 90% saturation (Anderson et al. 1994).

The current pH standard for the Umpqua Basin is from 6.5 to 8.5. Acid mine drainage from the Silver Butte mine is suspected to have caused pH values in a tributary of Middle Creek to exceed state standards. During active runoff periods, pH values between 4 and 5 were measured close to the mine. In the main stem of Middle Creek, above the South Fork of Middle Creek, and in the South Fork of Middle Creek

pH values were 7.8 and 8.0 respectively on August 20, 1996. These pH values are at the upper range of the state water quality standards. On-going monitoring of these streams should determine the success of restoration efforts.

The current standards for DO are "not less than 95% saturation in spawning areas during spawning, incubation, hatching, and fry stages of salmonid fish and not less than 90% saturation during seasonal low flows". During the summer of 1992, the daily minimum dissolved oxygen in Cow Creek at Riddle was less than 90% saturation most of the time. The dissolved oxygen level was further reduced by the Riddle wastewater treatment plant (WWTP) causing periphyton growth downstream from Riddle (Tanner and Anderson 1996). Dissolved oxygen measurements taken on August 20, 1996 in both Middle Creek and the South Fork of Middle Creek were within state standards.

Stream temperatures in lower and upper Middle Creek and the South Fork of Middle Creek exceeded the Umpqua Basin temperature standard of 64 degrees Fahrenheit (F) during most of the summers of 1994 and 1995 (see Graphs 1 and 2). Lower and upper Middle Creek and the South Fork of Middle Creek exceeded 64 degrees Fahrenheit for 57, 39, and 55 percent of the summer in 1994, respectively. The warm stream temperatures lasted well into August for the South Fork of Middle Creek and upper Middle Creek and into September for lower Middle Creek. All three sites exhibited little thermal recovery, at night. During the summer, maximum stream temperatures were at lethal thresholds for resident and salmonid fish (see Table 9). Other aquatic organisms were probably severely stressed during the same period.

Table 9. Percent of Time Stream Temperatures Exceeded the Umpqua Basin Standard.

Lower and Upper Middle Creek Subwatersheds

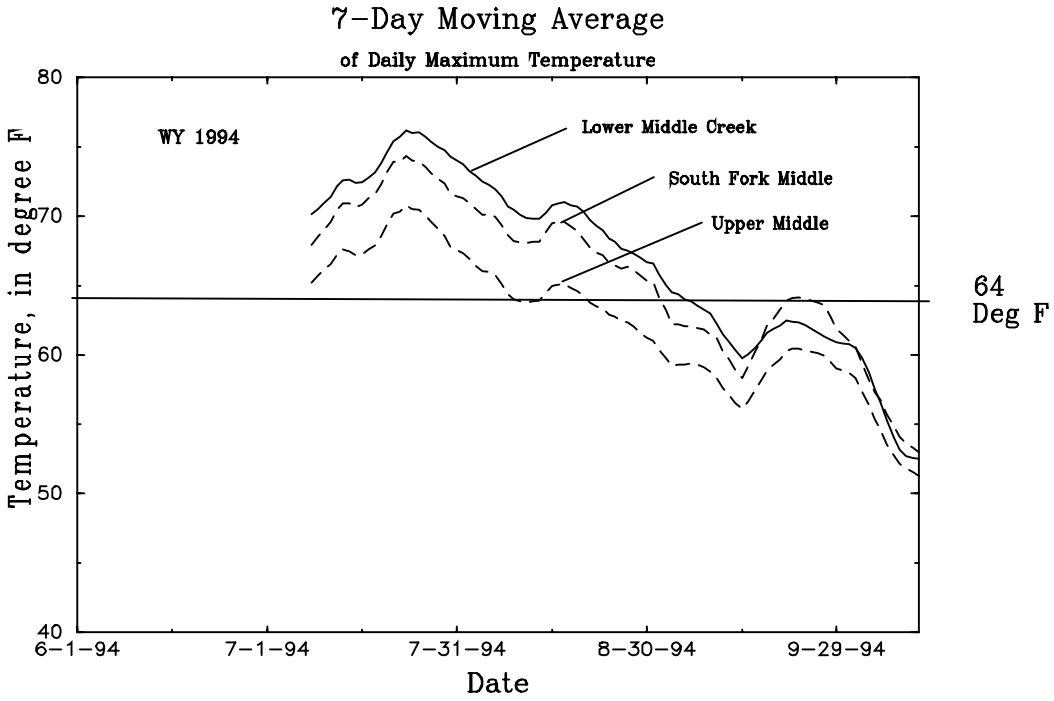
Summer 1994

Temperature Requirements for Cutthroat Trout and Salmonids	South Fork of Middle Creek (%)	Upper Middle Creek (%)	Lower Middle Creek (%)
Less than 55E F (Cutthroat Trout)	9	5	10
Less than 57E F (Salmonids)	12	6	13
Lethal Limits: 73E F - Cutthroat 79E F - Salmonids	9 0	0 0	16 0

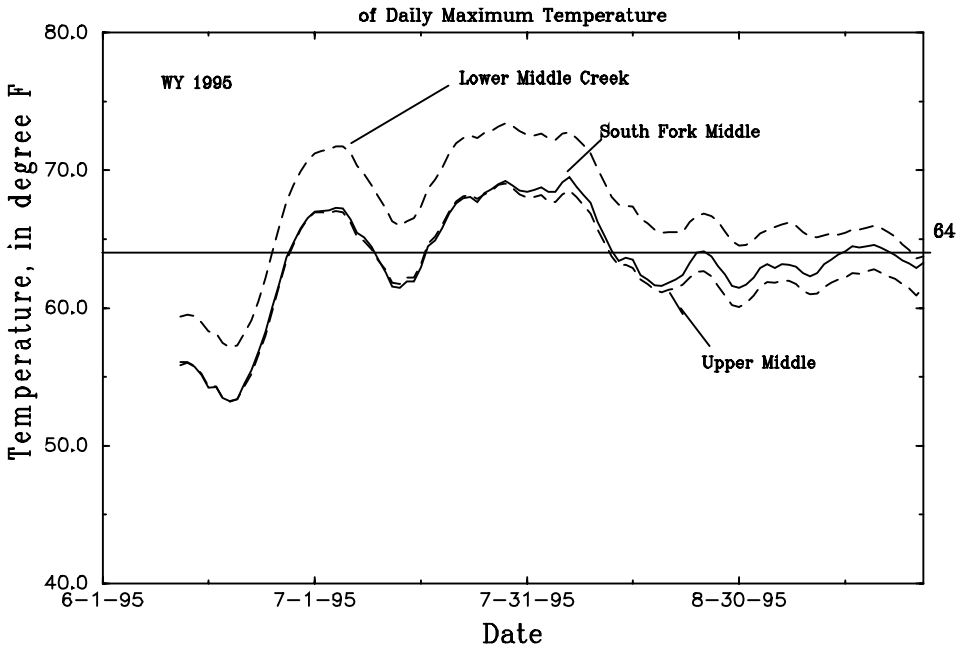
Summer 1995

Temperature Requirements for Cutthroat Trout and Salmonids	South Fork of Middle Creek (%)	Upper Middle Creek (%)	Lower Middle Creek (%)
Less than 55E F (Cutthroat Trout)	5	5	0
Less than 57E F (Salmonids)	11	11	6
Lethal Limits: 73E F - Cutthroat 79E F - Salmonids	0 0	0 0	3 0

Graph 1. Stream Temperature Data For 1994.



Graph 2. Stream Temperature Data For 1995.



The width and height of riparian vegetation needed to provide effective shade varies according to the width of the stream, the direction of flow (orientation to the sun), and the steepness of the streambanks. Studies have investigated the effects of riparian vegetation on stream temperatures in Pacific Northwest forests. Holaday (1992) found a trend of decreasing temperatures with recovering riparian vegetation. Stream channel characteristics can also affect stream temperatures. Streams with narrow channels tend to have cooler stream temperatures. The wetted width at the lower Middle Creek site is fairly wide and riparian vegetation does not provide effective shade. The stream reach at the site is characterized by simplified stream substrate and dominated by bedrock.

4. Low Summer Flows

Summer low flows may be affected by human water withdrawals. An inventory of water rights for the Cow Creek basin lists appropriated permits totaling 543 cubic feet per second. Irrigation and agriculture (65.1 cfs appropriated) and mining (229.4 cfs appropriated) have contributed to the lower volumes of water being present in stream channels during the summer months. The amount of water withdrawn each year is unknown, but water removal during the summer can potentially decrease available habitat for aquatic life, increase water temperatures, reduce DO, and reduce pH due to reduced flows and periphyton growth.

The removal of large wood from the channel can cause the release of accumulated gravel to be transported downstream. In a healthy stream channel, gravel storage areas act as large sponges, holding cool groundwater and releasing it slowly. In bedrock dominated channels, intergravel flow is greatly diminished and stream temperatures increase. Roads may also affect the amount of water in a stream by intercepting surface and subsurface water causing water to be delivered to stream channels instead of recharging groundwater reserves.

5. Streamflow

Ninety-four percent of the runoff occurs from October to April, due to precipitation rather than snowmelt. The least amount of runoff occurs from July through September (see Tables D-1, D-2, and D-3, and Chart D-1 in Appendix D). Many headwater tributaries dry up during this period. Most fourth order and larger streams flow year-round, obtaining extra moisture from the upstream catchment. First and second order streams dry up during the summer months since they have less developed riparian, floodplain, and alluvial areas.

The flow in Cow Creek has been regulated by Galesville Reservoir since 1985. The reservoir protects downstream communities from flooding. Flow during the summer is augmented by the reservoir and is reflected in the percent annual runoff values for the Azalea and Riddle gaging stations. The West Fork Cow Creek gaging station is not affected by diversions and the percent annual runoff values are similar to the Azalea gaging station prior to construction of the Galesville dam. The reservoir is critical in maintaining instream flows during the hot, dry summers to support aquatic species, riparian vegetation, and recreation. The reservoir supplies approximately 50 cfs during the summer, which accounts for over half of the flow at the South Umpqua River at Brockway gaging station.

The flows shown in Table 10 may be useful for estimating flows at ungaged sites for fish passage through a pipe or designing instream projects within the Cow Creek WAU. For a particular site (culvert) the average annual discharge of a stream varies with the size of the drainage basin if the climate is approximately uniform throughout the watershed. For a homogeneous hydrologic region the average annual flood at ungaged sites can be estimated by plotting the average annual discharge versus the drainage area on double log paper. Changes in geology, precipitation amounts, and soils types should also be considered when calculating flows for small ungaged drainage basins.

Table 10. Discharge and Recurrence Intervals for Storm Events at Gaging Stations on Cow Creek.

Recurrence Interval (Years)	1.25	2	5	10	25	50	100
Exceedance Probability	80%	50%	20%	10%	4%	2%	1%
Cow Creek near Riddle Discharge (cfs)	13,200	20,300	29,800	35,700	42,700	47,500	52,100
Cow Creek near Azalea Discharge (cfs)	1,440	2,780	4,860	6,280	8,040	9,300	10,500
West Fork Cow Creek Discharge (cfs)	4,580	6,700	9,570	11,400	13,700	15,300	16,900

The heavy precipitation in November and December of 1996 produced 1.6 and 5-year recurrence interval floods at the Cow Creek near Riddle gaging station. Flood stage at Riddle is between 18 and 22 feet. The gage heights for the November and December storms were 15.75 feet and 22.45 feet, respectively. The flows were 15,890 cfs and 27,240 cfs, respectively. Floods shape streams by building bars and forming the floodplain. Floods also damage human structures such as culverts and fish structures. Flood peaks in 1955, 1964, 1971, 1974, 1981, and 1983 exceeded the 1996 flood events (see Table 11). Bankfull flows build new floodplains and create undercut banks, which are important to aquatic species. Except for landslide impacted riparian areas, changes derived from flooding would be a net gain in aquatic habitat.

Table 11. Cow Creek near Riddle Gaging Station Flood Records.

Year	Gage Height	Flow	Recurrence Interval
1955	27.35 feet	36,660 cfs	10-year
1964	27.67 feet	37,300 cfs	Greater than a 10-year
1971	25.01 feet	32,070 cfs	5-year
1974	28.17 feet	38,310 cfs	22-year
1981	24.42 feet	30,930 cfs	5-year
1983	26.79 feet	35,550 cfs	10-year

6. Peak Flow Characteristics

Changes in the volume and timing of peak flows have probably occurred in the Cow Creek WAU. The extent this has affected channel condition and aquatic habitat is presently unknown. Elevated peak flows in some of the smaller drainages may hinder the natural and recovery processes within streams by preventing aggradation and sorting of bedload, and by hindering revegetation and stabilization of streambanks. A review of 1994 aerial photographs detected relatively narrow valley widths and straight channel reaches in Cow Creek. Many of the stream reaches in fourth order and smaller streams are steep Rosgen "A" type channels, with less developed floodplain and riparian areas. Stream sinuosity is generally less than 1.1, indicating straighter stream channels. Channel sinuosity is also an indicator of how stream channel slope is adjusted to the valley slope. The combination of narrow valley widths and less meander can lead to down-cut stream reaches and streams becoming disconnected from the floodplain. Roads along streams further restrict channel migration and development of floodplain and riparian areas. Vegetative manipulation and road construction are two management activities that increase peak flows. The hydrologic efficiency of Cow Creek is largely determined by the geology, soils, vegetation, drainage network, and topography. Jones and Grant (1996), Harr (1981), and Christner (1981) showed that canopy removal and roads may increase peak flow up to 50 percent in the Western Cascades. Table 12 shows the percentage of the WAU in early seral stage vegetation, road densities, stream crossings, and drainage densities.

Forest canopy removal, as well as roads, can affect peakflows. Snow in forest openings is more susceptible to rapid snowmelt during warm winter rains than snow stored under tree canopies with at least 70 percent crown closure (Coffin and Harr 1992). Forest stands with less than 70 percent crown closure (generally stands less than 40 years old) have the potential to deliver more water to the soil which contributes to increased peakflows. The United State Forest Service (USFS) developed a hydrologic recovery procedure to evaluate the cumulative effects of timber harvest within the Transient Snow Zone (TSZ) on peakflows. The Cow Creek WAU has a rain dominated precipitation regime, but several drainages may be affected by rapid snowmelt processes in the Transient Snow Zone (elevations between 2,000 and 5,000 feet). The amount of each drainage in the Transient Snow Zone and the percent considered hydrologically recovered is shown in Table 13.

The drainages likely to be affected by increased flows from rain-on-snow events are Buck Martin, Cedar Smith, Gravel Brush, Iron Mtn., Panther Peavine, South Fork Middle Creek, Upper Middle Creek, and Upper Union based on the data shown in Table 13. It would be important to determine potential impacts to channel stability in these drainages through Proper Functioning Condition and/or Rosgen stream classification field studies. The hydrologic recovery was determined using a site class of four, because 74% of the WAU is in this site class. The differences in hydrologic recovery between site classes are relatively small.

Table 12. Mile of Roads and Streams, Stream Crossings, and Densities in the Cow Creek WAU.

Subwatershed Name Drainage Name	Acres	Square Miles	Miles of Roads	Road density (miles per square mile)	Miles of Streams	Stream drainage density (miles per square mile)	Stream Crossings per Stream Mile
Lane-Judd	24,574	38.40	212.51	5.53	154.02	4.01	
Jerry Creek	3,879	6.06	28.58	4.72	26.09	4.30	2.63
Judd Creek	3,663	5.72	22.83	3.99	34.74	6.07	1.18
Lane Creek	1,936	3.03	12.33	4.08	14.05	4.64	1.85
Nickle Mountain	1,315	2.05	18.43	8.97	7.85	3.82	5.32
Riddle	4,365	6.82	37.36	5.48	16.51	2.42	0.92
Tri City North	2,785	4.35	27.37	6.29	22.54	5.18	1.24
Tri City South	3,547	5.54	32.29	5.83	15.82	2.85	0.82
Weaver Road	3,083	4.82	33.32	6.92	16.42	3.41	2.58
Lower Cow Creek	20,880	32.63	153.63	4.71	221.52	6.79	
Beatty Creek	2,351	3.67	9.56	2.60	21.01	5.72	2.11
Buck Creek	3,239	5.06	22.74	4.49	39.90	7.89	2.13
Doe Creek	4,210	6.58	43.56	6.62	53.12	8.08	3.10
Iron Mountain	2,609	4.08	17.98	4.41	23.82	5.84	1.26
Island Creek	3,572	5.58	26.32	4.72	32.82	5.88	2.07
Paten Creek	2,217	3.46	11.62	3.36	20.96	6.05	1.48
Salt Creek	2,683	4.19	21.85	5.21	29.89	7.13	1.92
Middle Cow Creek	11,532	18.02	80.16	4.45	139.67	7.75	
Cattle Creek	3,652	5.71	34.69	6.08	51.21	8.97	3.36
Little Dads Creek	2,258	3.53	18.53	5.25	32.86	9.31	2.94
Table Creek	5,622	8.78	26.94	3.07	55.60	6.33	1.08
Upper Cow Creek	17,692	27.64	135.99	4.92	245.38	8.87	
Darby Creek	3,364	5.26	22.17	4.22	47.07	8.96	2.38
Dutchman Creek	2,847	4.45	20.78	4.67	39.02	8.77	2.61
Lower Union	2,918	4.56	32.05	7.03	43.87	9.62	4.38
Tough Cow	3,319	5.19	27.03	5.21	55.60	10.7	3.44
Upper Union	5,245	8.20	33.96	4.14	59.82	7.30	2.51

Table 12. Mile of Roads and Streams, Stream Crossings, and Densities in the Cow Creek WAU.

Subwatershed Name Drainage Name	Acres	Square Miles	Miles of Roads	Road density (miles per square mile)	Miles of Streams	Stream drainage density (miles per square mile)	Stream Crossings per Stream Mile
Lower Middle Creek	15,321	23.94	142.42	5.95	216.64	9.05	
Audie Creek	2,399	3.75	25.42	6.78	37.80	10.1	4.22
Buck Martin	2,271	3.55	22.67	6.39	29.00	8.17	3.01
Cedar Smith	2,458	3.84	22.51	5.86	32.35	8.42	2.73
Hare Creek	2,323	3.63	22.74	6.26	45.67	12.6	4.04
Lower Middle Creek	2,388	3.73	23.93	6.41	37.12	9.95	4.16
Martin Creek	3,482	5.44	25.15	4.62	34.70	6.38	2.81
Upper Middle Creek	11,600	18.13	111.54	6.15	162.06	8.94	
Gravel Brush	2,776	4.34	29.40	6.78	48.05	11.1	3.17
Panther Peavine	2,357	3.68	21.79	5.92	27.85	7.56	3.46
South Fork Middle Creek	4,156	6.49	39.32	6.05	52.60	8.10	3.03
Upper Middle Creek	2,311	3.61	21.03	5.83	33.56	9.29	2.75
Russel Creek	16,741	26.16	144.56	5.52	154.32	5.90	
Catching Creek	3,639	5.69	25.24	4.44	34.95	6.15	1.53
Council Creek	2,855	4.46	24.56	5.51	26.82	6.01	1.96
Mitchell Creek	4,147	6.48	36.43	5.62	33.46	5.16	2.53
Russel Creek	4,250	6.64	38.55	5.81	40.74	6.14	2.70
Shoestring	1,850	2.89	19.78	6.84	18.35	6.35	3.77
Total in Cow Creek WAU	118,340	184.91	980.81	5.30	1,294	7.00	

Table 13. Acres and Percent of Each Drainage in the Transient Snow Zone and the Percent Hydrologically Recovered.

Drainage	Acres in Transient Snow Zone	Percent of Drainage in the TSZ	Percent of acres hydrologically recovered in TSZ (Assuming a Site Class of 4)
Audie Creek	1,087	45	66
Beatty Creek	504	21	99
Buck Creek	1,182	36	40
Buck Martin	1,308	58	35
Catching Creek	1,236	34	95
Cattle Creek	1,412	39	58
Cedar Smith	1,260	51	55
Council Creek	1,062	37	66
Darby Creek	1,069	32	99
Doe Creek	1,098	26	48
Dutchman Creek	1,540	54	56
Gravel Brush	1,865	67	58
Hare Creek	1,091	47	70
Iron Mtn.	1,373	53	43
Island Creek	1,012	28	59
Jerry Creek	408	11	89
Judd Creek	1,058	29	90
Lane Creek	402	21	65
Little Dads Creek	418	18	72
Lower Middle Creek	954	40	40
Lower Union	1,065	36	59
Martin Creek	2,191	63	76
Mitchell Creek	1,154	28	92
Nickle Mtn.	222	17	100

Table 13. Acres and Percent of Each Drainage in the Transient Snow Zone and the Percent Hydrologically Recovered.

Drainage	Acres in Transient Snow Zone	Percent of Drainage in the TSZ	Percent of acres hydrologically recovered in TSZ (Assuming a Site Class of 4)
Panther Peavine	1,532	65	63
Paten Creek	379	17	62
Riddle	0	0	Not Applicable
Russel Creek	1,877	44	89
Salt Creek	463	17	56
South Fork Middle Creek	3,729	90	45
Shoestring	67	4	52
Table Creek	1,524	27	67
Tough Cow	1,418	43	71
Tri City North	13	less than 1	54
Tri City South	0	0	Not Applicable
Upper Middle Creek	1,739	75	58
Upper Union	3,196	61	70
Weaver Road	136	4	74

7. Sedimentation

Many studies have documented the detrimental effects of increased sediment loads to channel morphology and the aquatic habitat. Roads adjacent to stream channels are the mechanisms for sediment delivery, especially during winter storms when culverts plug and debris torrents occur. Indirect effects of increased sediment loads may include increased stream temperatures and decreased intergravel dissolved oxygen (DO) (MacDonald et al. 1990). In 1991, benthic macroinvertebrate sampling and evaluations were done on the West Fork of Cow Creek, Union Creek, and Iron Mountain Creek. The species present, population, and diversity of macroinvertebrates are indicators of water quality. Certain organisms are sensitive to changes in the aquatic environment, such as excessive amounts of sand and silt. Low or moderate levels of fine sediment can greatly depress invertebrate abundance on stream margins and inhibit scrapers. Bioassessments were done on these streams and expressed as a percent of maximum score. This was done in order to relate site bioassessments to water and habitat quality problems that currently exist at each site. A bioassessment score between 80 and 100 percent is considered nonimpaired, between

60 and 79 percent is slightly impaired, between 40 and 59 percent is moderately impaired, and less than 40 percent is considered severely impaired. The percent of maximum bioassessment scores for the West Fork of Cow, Union, and Iron Mountain Creeks are 37, 39, and 53. Union and the West Fork of Cow Creeks are severely impaired, while Iron Mountain Creek is moderately impaired. The high road density and Riparian Reserve conditions in the Union and Iron Mountain Creek drainages probably contributed to current invertebrate habitat conditions. Iron Mountain Creek had a higher bioassessment score and has a higher percentage (71%) of acres in Riparian Reserves that are 80 years old and older, whereas Union Creek had a lower bioassessment score and a lower percentage (40%) of acres in Riparian Reserves that are 80 years old and older than Iron Mountain Creek.

Suspended sediment and turbidity studies were conducted by Onions (1969), Curtiss (1982), and Rinella (1986) on the main stem of Cow Creek. Onions and Curtiss determined baseline and storm event suspended sediment and turbidity values at the Cow Creek near Azalea gaging station. The drainage area at the gage is 78 square miles. Only one storm event occurred during the sampling period from December 2-4, 1980. The discharge during the storm was 4,020 cfs, a four-year recurrence interval, and yielded 4,050 tons of sediment in three days. This storm produced 95% of the total estimated load of 4,270 tons for water year 1981. The characteristics controlling the sediment regime have not changed appreciably since the analysis by Onions and Curtiss. A particle analysis done in Cow Creek yielded clay-sized particles.

The study by Rinella (1986) displays the data differently than previous studies and used a larger drainage area, 456 square miles, based on data from the Cow Creek near Riddle gaging station. Table 14 lists sediment loads and the percentage of time sediment yields were less than or equal to some value. Generally, there is a positive correlation between suspended sediment and discharge. Suspended sediment loads reach a maximum during winter storms when streams experience bankfull or greater discharges and reach a minimum during the hot, dry summer months.

Table 14. Sediment Loads and Yields for the Cow Creek near Riddle Gaging Station.

Percent of time Greater than or Equal to	5	10	25	50	75	90
Pounds of Sediment per Day per Square Mile	0.67	0.80	1.4	5.8	47	381
Tons of Sediment per Year	56	67	116	483	3,911	31,707

Annual load and yield, and median load data for water year 1977 were 140 tons per year, 0.3 tons per year per square mile, and 1.3 tons per day, respectively. Since a large storm event did not occur in 1977, suspended sediment loads are less than the 4-year storm event in water year 1981. Moreover, suspended sediment yields and loads were calculated using sediment transport curves and based on monthly samples, whereas Curtiss used flow-duration curves based on 18 years of streamflow records. The Rinella study was based on a smaller data set and will yield lower estimates than those in the Curtiss study. Unfortunately, the studies included a large drainage area, and did not discuss drainages such as Cattle Creek or Iron Mountain. Small increases in sediment loads in Cow Creek probably have occurred since the 1982 study, because of recent road building in the Cow Creek WAU. Increased sediment due to roads may increase streambank erosion and subsequent widening of the stream channel. Monitoring

sediment concentrations would require sampling high discharge events and taking continuous discharge measurements over a period of time to substantiate the premise that sediment loads in streams have increased. In western Oregon, first, second, and third order streams drain more than 80 percent of the commercial forest land (Harr et al. 1975). These streams are important fish rearing and spawning areas. They also transport gravel, wood, and sediment to downstream areas.

8. Erosional Processes

Geomorphic processes of surface erosion, earthflows, and landslides are natural cyclic processes that strongly influence hydrologic, aquatic, and riparian habitat quality. Streams cutting through active earthflows tend to undermine inner gorges and provide a natural source of sediment and large wood to the downstream floodplain. Slumps and earthflows are deep-seated land movements that develop in deep, fine-textured soils where groundwater movement is restricted. Earthflows are seasonally active with most displacement occurring during winter and spring after soils become super saturated and high water tables develop, as was the case during the November and December 1996 flood events. These processes can change stream morphology and result in the loss of riparian vegetation. In areas underlain by granitic bedrock, soils dry out early in the summer, lack cohesion, and dry ravel can be a significant source of surface erosion.

Debris flow susceptibility in the Cow Creek WAU was determined using geology, problem soils, and landslide potential maps. Areas with higher landslide potential and problem soils are assumed to generate debris flows over time. However, an on-the-ground evaluation would be necessary to validate the debris flow susceptibility. Debris flow hazard to fish-bearing streams was assumed to be a function of channel gradient and tributary junction angle. Debris flow hazards are greater where channel gradients are greater than 3 degrees or tributary junction angles are less than 70 degrees. United States Geological Survey (USGS) 7 ½ minute quads were used to determine gradients and tributary angles for only those streams shown on the USGS maps. These criteria fit most of the headwater tributaries within the WAU. Doe, Martin, and Lower Union Creeks have low gradient stream reaches extending almost to their headwaters. Streams, and their tributaries, that have a large number of reaches with gradients greater than 3 degrees and tributary angles less than 70 degrees are Upper Union, Dutchman, Buck (in the Lower Cow Creek subwatershed), Salt, Cattle, Island, Brush, Upper Middle, Panther, Peavine, Gravel, Iron Mountain, and the South Fork of Middle Creeks.

Excessive sediment inputs to streams, outside of the natural range of variability, may adversely impact the aquatic environment. Excessive sediment may reduce species diversity of macroinvertebrate communities, salmonid reproduction and growth, intergravel dissolved oxygen, and pool depth. Buck Martin, Iron Mountain, Upper Union, South Fork Middle Creek, and Gravel Brush Drainages have a high debris flow hazard, high road densities (greater than 4 miles per square mile), and potentially unstable soils, which contribute to a greater potential for introducing sediment into the streams.

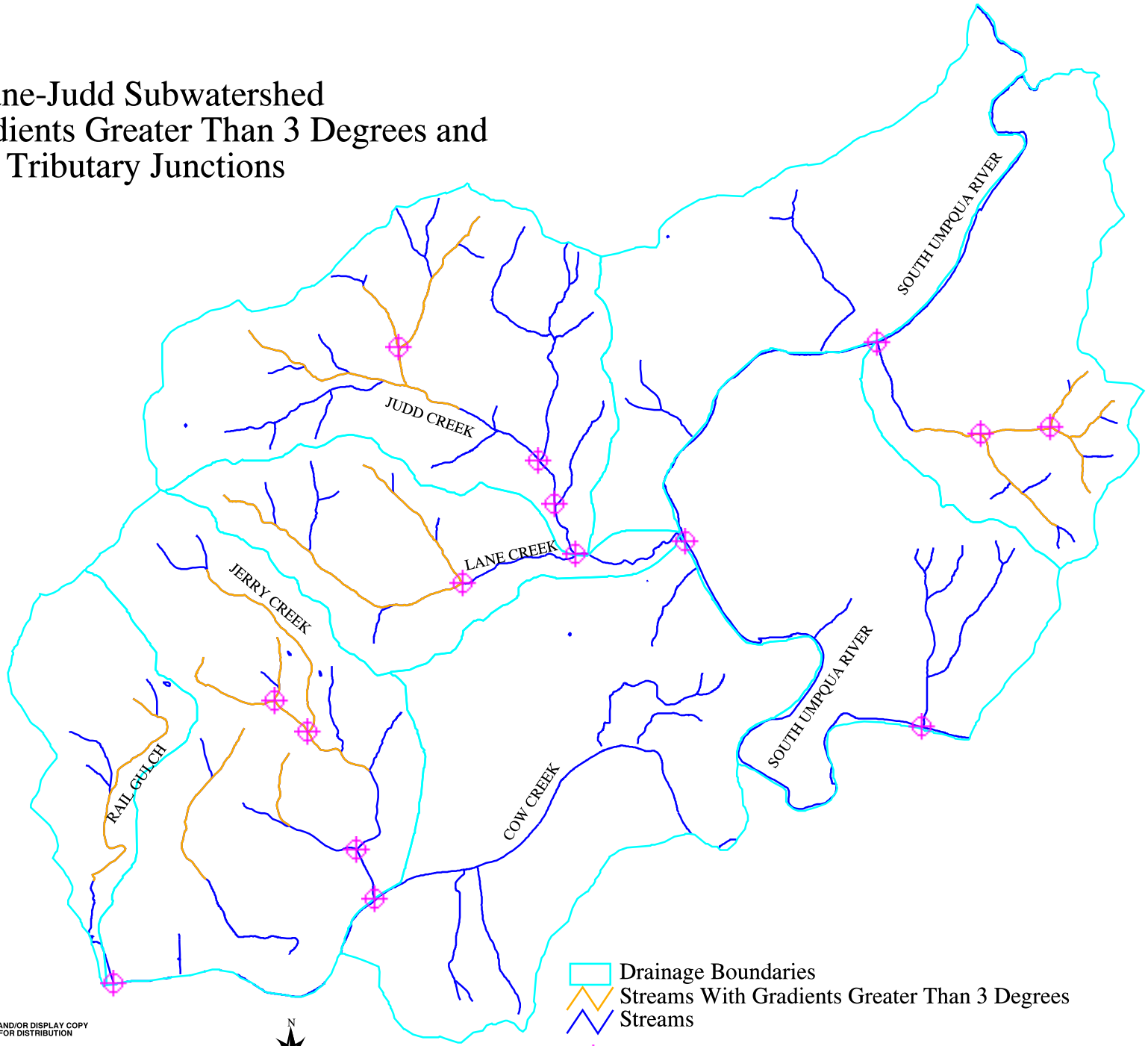
9. Large Woody Debris

Large woody debris (LWD) provides benefits to channel morphology and the aquatic environment. Harvesting of large woody debris adjacent to and within streams occurred decades ago, so determining pre-settlement large woody debris loadings for comparative purposes is extremely difficult. The diameter and length of large woody debris required for stream stability increases with increasing stream size. Long term changes in sediment routing, the aquatic environment, and channel morphology, such as channel downcutting and widening may be expected where there is a lack of large wood for recruitment. Attempts at restoring historical numbers and volumes of large woody debris in streams may be inappropriate for some stream types, since streams are constantly seeking equilibrium. The debris flow maps (see Maps 14 through 20) provide preliminary information for determining areas where large woody debris and sediment may have been deposited historically. Areas of high sediment storage probably occur in low gradient reaches. Streams with tributary angles greater than 70 degrees may accumulate large woody debris, developing pools that provide excellent aquatic habitat. Recurring peak flows, over long periods of time, may deposit large woody debris to low gradient fish-bearing stream reaches downstream. The BLM is currently conducting Proper Functioning Condition surveys which may help determine areas in need of large woody debris.

10. Proper Functioning Condition

In 1991 the BLM Director approved a Riparian-Wetland Initiative for the 1990s, which established national goals and objectives for managing riparian-wetland areas on public lands. The primary goal is to maintain and restore riparian-wetland areas so that 75 percent or more are in proper functioning condition (PFC). Proper Functioning Condition surveys have been conducted on portions of Cattle, Iron Mountain, Middle, and Union Creeks. A summary of PFC surveys conducted in the Cow Creek WAU is listed in Table 15. Stream reaches determined to be functioning at risk were on a downward trend due to road encroachment, culverts, and small stream buffers. Road fills on steep side slopes entering Union Creek are causing the stream to straighten and incise. There is a lack of large woody debris in Union Creek that could, if it was present, prevent the channel incision. Channel downcutting occurring in these reaches has limited riparian diversity. The downward trend reaches indicated the vegetation was no longer diverse in composition, age, size, or structure and was not capable of protecting the stream channel from degradation. The 0.92 miles of streams determined to be non-functional in Cattle and Middle Creeks was due to the lack of vegetation and LWD necessary to dissipate stream energies associated with high flows. The stream reaches designated as Functioning at Risk on an upward trend had some large woody debris and floodplains were inundated every 1 to 3 years. However, these areas did not have natural riparian plant communities and were considered "at-risk." These assessments of PFC are expected to continue in the future and updated information would be added to the watershed analysis.

Map 14. Lane-Judd Subwatershed
Stream Gradients Greater Than 3 Degrees and
High-Angle Tributary Junctions



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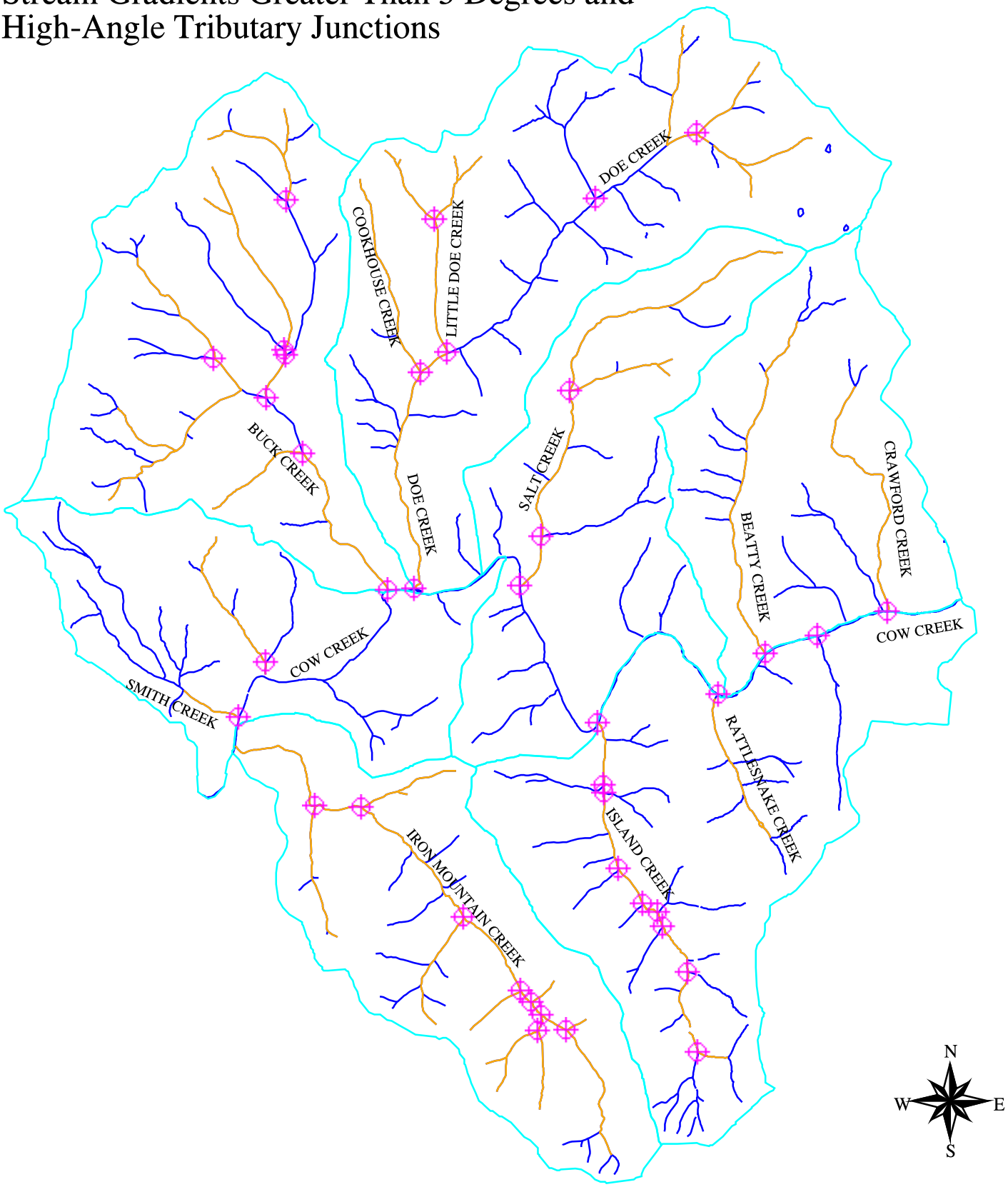
Map 15. Lower Cow Creek Subwatershed Stream Gradients Greater Than 3 Degrees and High-Angle Tributary Junctions



Drainage Boundaries
Streams With Gradients Greater Than 3 Degrees
Streams
Tributary Junctions Greater Than 70 Degrees

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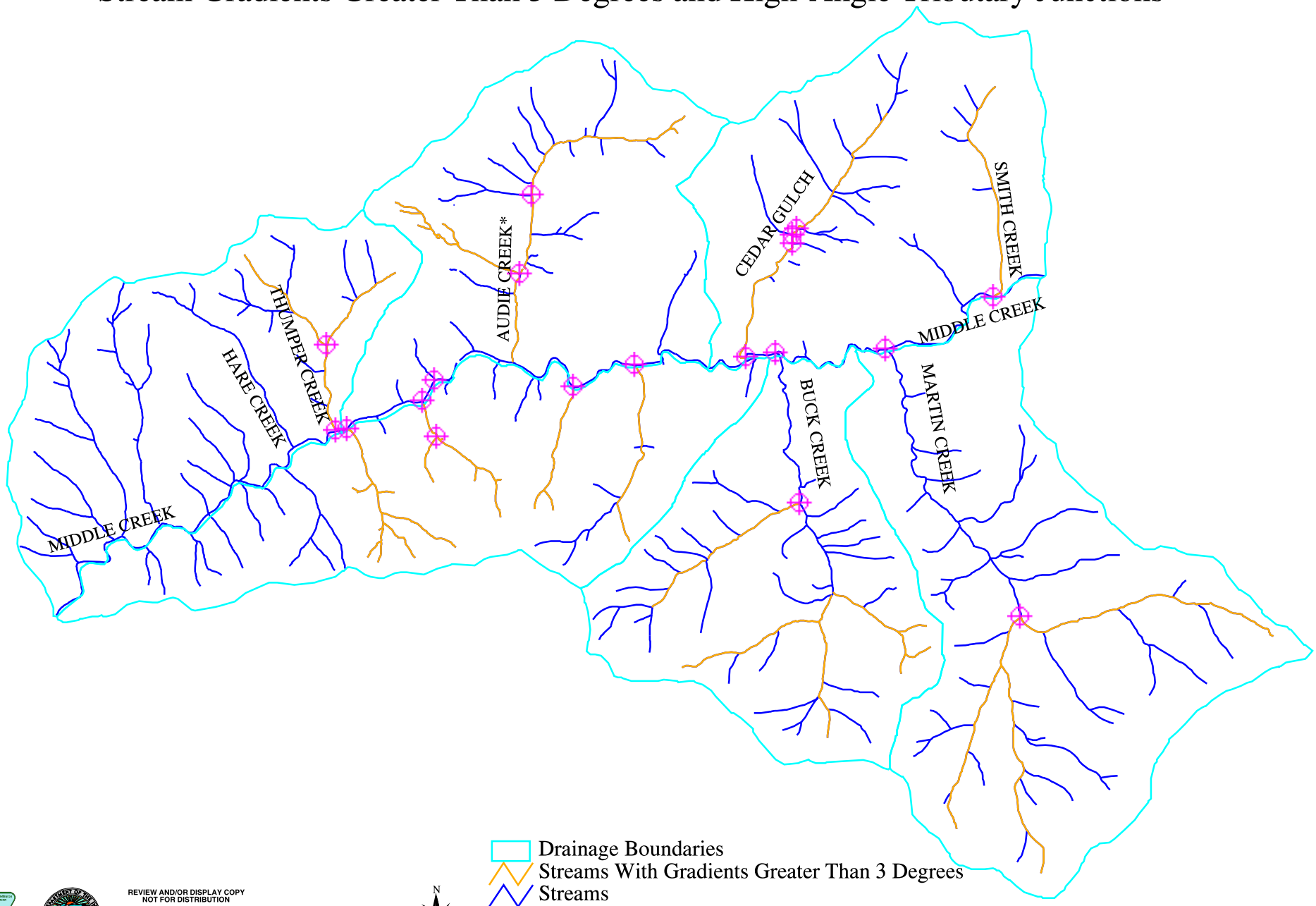
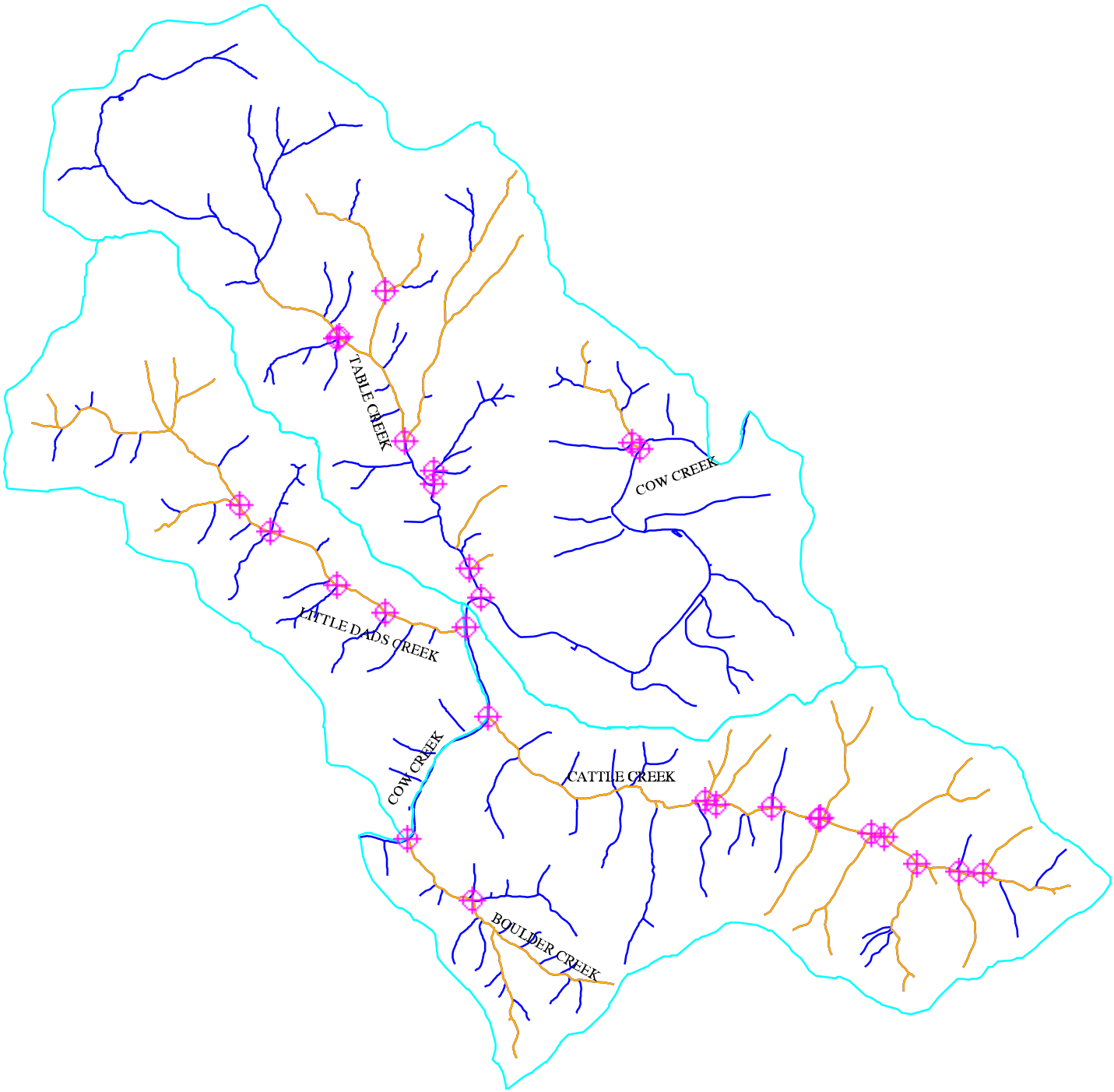
Map 16. Lower Middle Creek Subwatershed
Stream Gradients Greater Than 3 Degrees and High-Angle Tributary Junctions



Map 17. Middle Cow Creek Subwatershed Stream Gradients Greater Than 3 Degrees and High-Angle Tributary Junctions



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Drainage Boundaries
Streams With Gradients Greater Than 3 Degrees
Streams
Tributary Junctions Greater Than 70 Degrees

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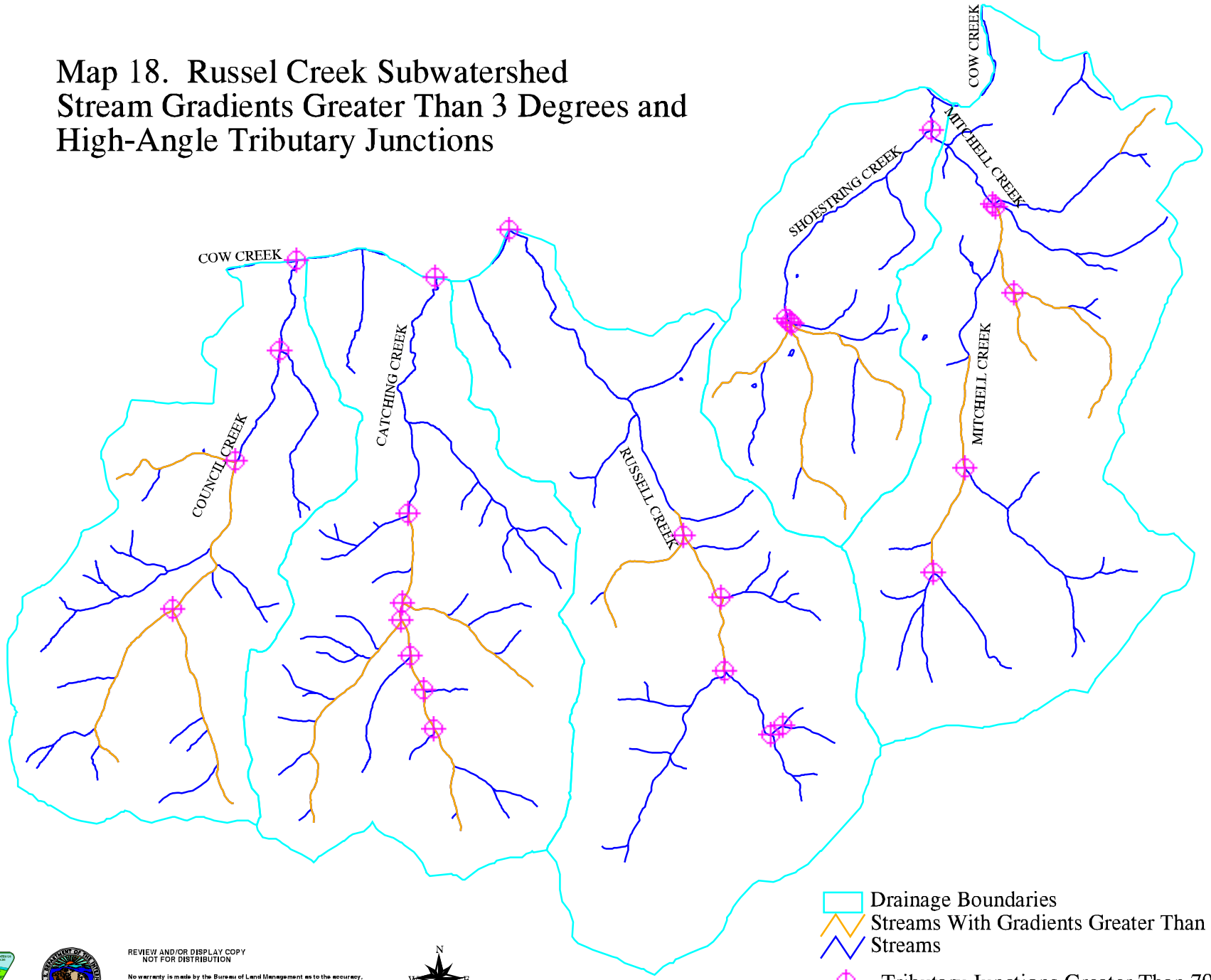
Map 18. Russel Creek Subwatershed
Stream Gradients Greater Than 3 Degrees and High-Angle Tributary Junctions



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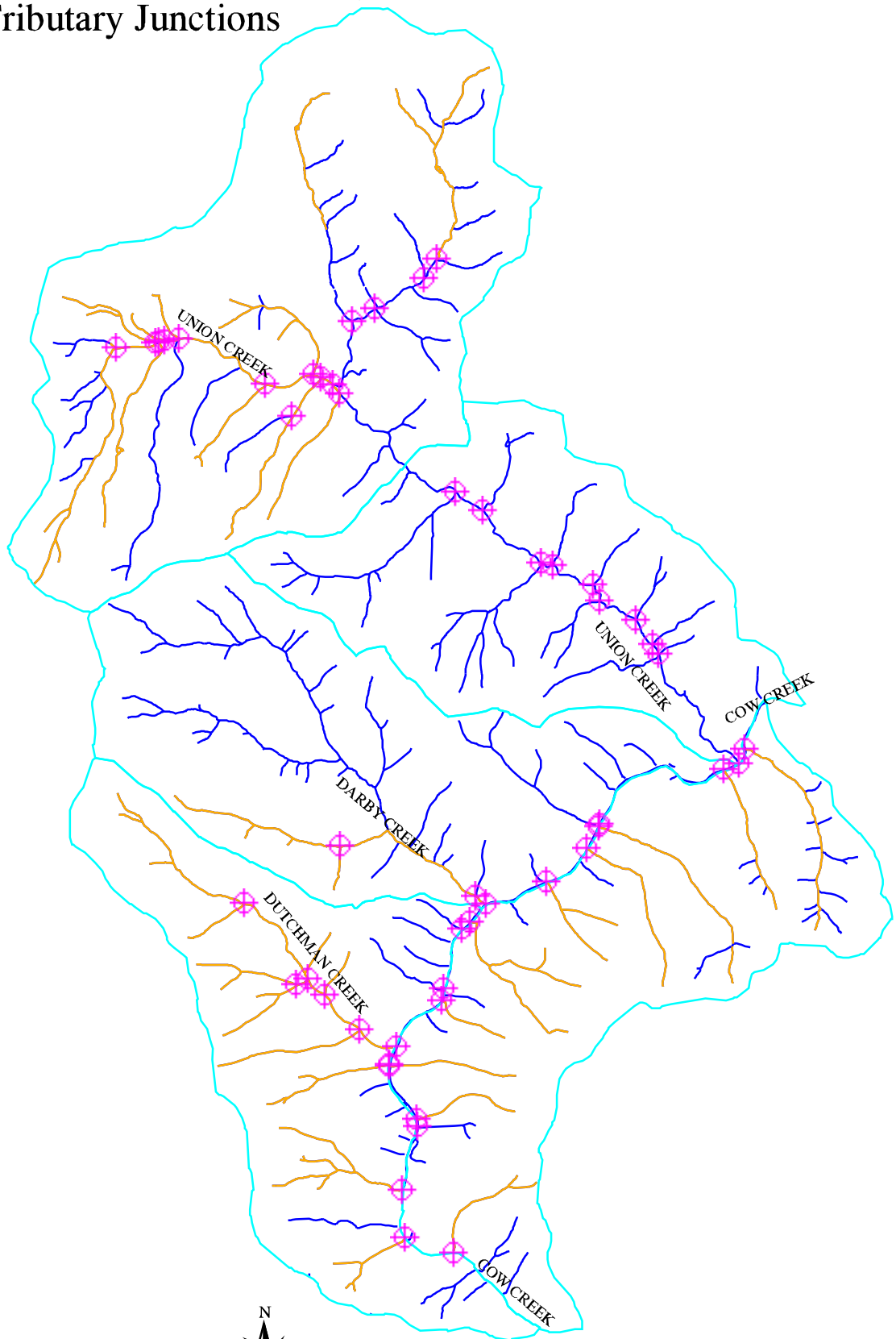
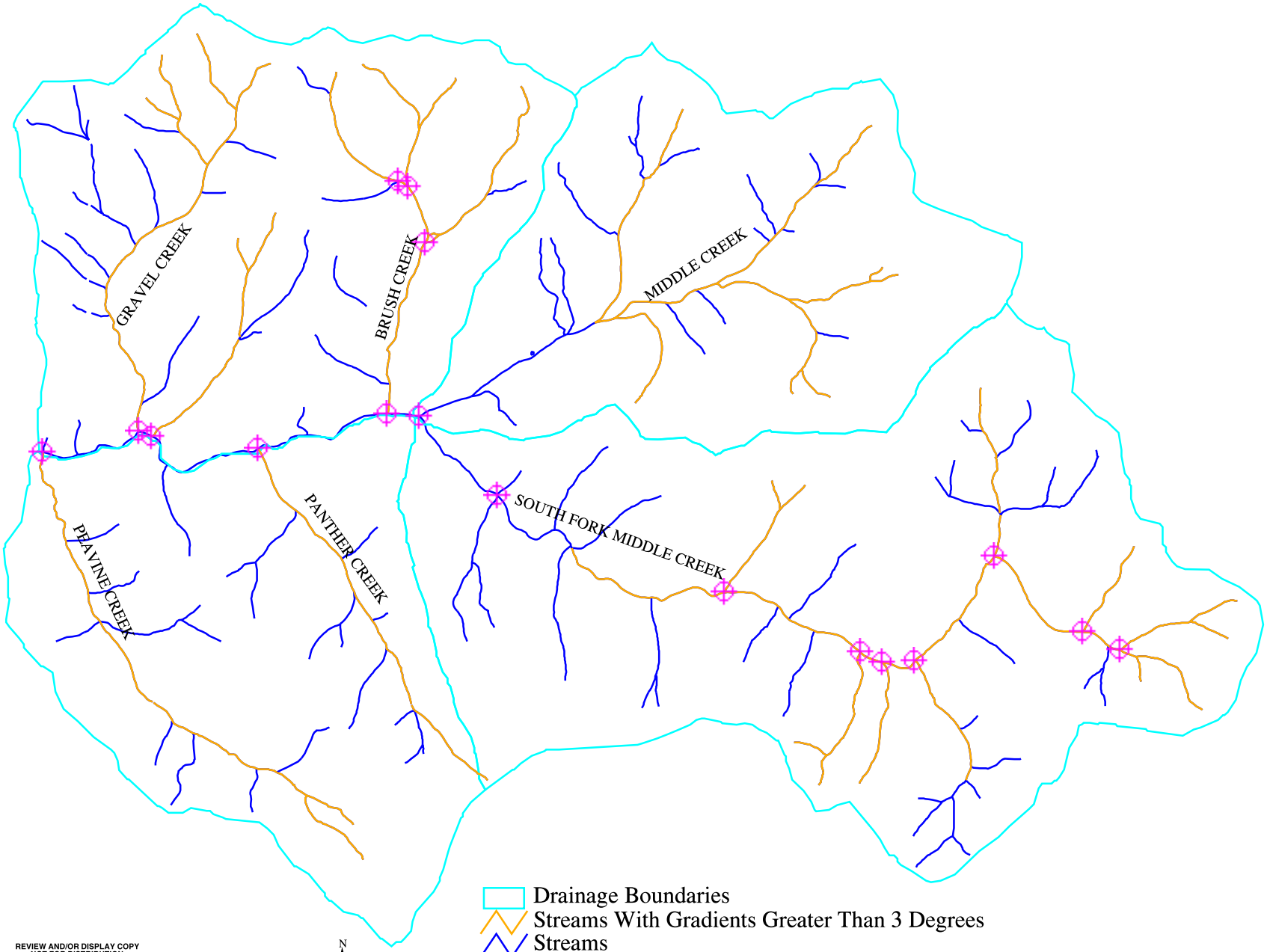
Map 19. Upper Cow Creek Subwatershed Stream Gradients Greater Than 3 Degrees and High-Angle Tributary Junctions



Map 20. Upper Middle Creek Subwatershed
Stream Gradients Greater Than 3 Degrees and High-Angle Tributary Junctions



Drainage Boundaries
Streams With Gradients Greater Than 3 Degrees
Streams
Tributary Junctions Greater Than 70 Degrees

Table 15. Percentages by Category for Proper Functioning Condition.

Stream Name	Miles Surveyed	% PFC (miles)	PFC Upward Trend	PFC Downward Trend	Functioning at Risk-Upward (miles)	Functioning at Risk-Downward (miles)	Non-functioning (miles)
Iron Mtn. Creek	4.8	60 (2.9)	N/A	N/A	23 (1.1)	17 (0.8)	N/A
Cattle Creek	1.72	32 (0.6)	N/A	N/A	N/A	14 (0.24)	54 (0.92)
Middle Creek	3.4	N/A	N/A	N/A	82 (2.8)	N/A	18 (0.6)
Union Creek	1.72	N/A	N/A	N/A	0.64 (37)	1.11 (63)	N/A

11. Geomorphology

The geomorphic processes associated with the effects of precipitation and runoff on the landscape are very important. The mechanisms of precipitation and runoff, along with anthropogenic activities can alter river morphology, erosional processes, and sediment production. A number of geomorphic parameters can be obtained from maps and GIS, which can be useful in identifying potential changes in channel morphology. For example, the removal of trees from riparian areas coupled with past landslide activities have resulted in a loss of streambank stability and excessive amounts of sediment moving through the WAU. Precipitation and subsequent runoff events probably have caused streams to widen over time.

Drainage density is defined as the length of all channels in the drainage basin divided by the basin area (Dunne and Leopold 1978). Drainage density is one of several linear measurements by which the scale of topographic features can be compared. Areas with high drainage density are associated with high flood peaks, high sediment production, and steep hillslopes. Many of the drainages in the Cow Creek WAU have drainage densities ranging from 6 to 17 miles per square mile. There are 1,284 miles of streams in the Cow Creek WAU with an average drainage density of 7.32 miles per square mile. Drainage areas and densities are listed in Table 12.

Wemple (1994) developed a process and investigated the effective extension of stream networks resulting from road drainage. She estimated that roads in her study area extended the stream network 60 percent over winter base flow stream lengths and 40 percent over storm event stream lengths. The road density in her study area was 1.6 miles per square mile. Road densities in the Cow Creek WAU range from 2.60 to 8.97 miles per square mile. Road drainage is probably a major cause of increased winter peak flows in streams, especially when roads parallel stream channels. Road cuts bring subsurface water to the surface routing the water to stream channels much quicker than in unroaded areas. The stream network is

effectively extended causing flows to peak higher and sooner. The Lower and Upper Middle Creek subwatersheds have the highest road densities (6 miles per square mile), stream drainage densities (9 miles per square mile), and stream crossings per stream mile (3.34) in the Cow Creek WAU. When the drainage density is increased by the construction of roads, more runoff in the form of increased peak flows and mean annual floods may occur. Drainage basins with fewer streams per square mile would experience higher winter peak flows as a result of roads than basins that naturally have a lot of streams (USDA and USDI 1995). There are fewer streams to handle the rapid runoff so streamflow increases are greater, potentially leading to down-cutting, bank failures, bed scour, and mass wasting where streams undercut adjacent slopes.

The number of stream crossings by roads that can be counted in GIS are shown in Table 12. The stream crossing density can be used as an indicator of the potential for culverts to plug and for peak flow increases from high stream crossing densities in the Cow Creek WAU. It is assumed that the highest stream crossing densities would have the greatest potential for peak flow increases from road related runoff. Stream crossings per stream mile range from one in the Riddle drainage to 5.32 in the Nickle Mountain drainage. The average for the Cow Creek WAU is 2.7 crossings per mile.

E. Species and Habitats

1. Fisheries

Middle Creek has been designated a Tier 1 Key Watershed. Tier 1 Key Watersheds were selected to conserve anadromous salmonids and should be given highest priority for watershed restoration (SEIS ROD B-19). Key Watersheds were designated to act as anchors for the potential recovery of depressed or at-risk anadromous and resident fish stocks by maintaining high quality aquatic habitat and recovering degraded aquatic habitat (SEIS ROD B-18).

a. Historic and Current Fish Use in the South Umpqua Basin

The South Umpqua River historically supported healthy populations of resident and anadromous salmonid fish. A 1937 survey conducted by the Umpqua National Forest reported that salmon, steelhead, and cutthroat trout were abundant throughout many reaches of the river and its tributaries (Roth 1937). Excellent fishing opportunities for resident trout and anadromous salmon and trout historically existed within the South Umpqua River (Roth 1937). The historical condition of the riparian zone along the South Umpqua River favored conditions typical of old-growth forests found in the Pacific Northwest. Roth noted the shade component that existed along the reaches of streams surveyed. The majority of the stream reaches surveyed were "arboreal" in nature, meaning "tall timber along the banks, shading most of the stream" (Roth 1937). The river and its tributaries were well shaded by the canopy closure associated with mature trees. Streambanks were provided protection by the massive root systems of these trees.

Since 1937, many changes have occurred within the South Umpqua Basin and in the stream reaches surveyed by Roth. A comparative study conducted by the Umpqua National Forest during the summer low-flow periods between 1989 and 1993 surveyed the same stream reaches in the 1937 report. The results of the study show 22 of the 31 stream segments surveyed were significantly different from the 1937 survey (Dose and Roper 1994). Nineteen stream segments became significantly wider while the remaining three stream segments were significantly narrower. Of the eight streams surveyed within designated wilderness areas, only one stream channel increased in width since 1937. In contrast, 13 of the 14 stream segments located in timber harvest emphasis areas were significantly wider than in 1937.

The stream widening could have resulted from increased peak flows. Peak flows typically occur due to the removal of vegetation (tree canopy) and the increase in compacted areas within a watershed, especially within the transient snow zone (Meehan 1991). Peak flows can introduce sediment into the channel from upslope and upstream and can also simplify the channel by rearranging instream structure. Excessive sediment delivery to streams usually changes stream channel characteristics and channel configuration. These stream channel changes normally result in decreasing the depth and the number of pool habitats and reducing the space available for rearing fish (Meehan 1991).

Winter steelhead and resident rainbow trout (Oncorhynchus mykiss), fall and spring chinook salmon (Oncorhynchus tshawytscha), coho salmon (Oncorhynchus kisutch), and sea-run cutthroat and resident cutthroat trout (Oncorhynchus clarki) have been documented using the Cow Creek WAU. Over the last

150 years, salmonids have had to survive dramatic changes in the environment where they evolved. The character of streams and rivers in the Pacific Northwest has been altered through European settlement, by urban and industrial development, and by land management practices. Modifications in the landscape and waters of the South Umpqua River Basin, beginning with the first settlers, have made the South Umpqua River less habitable for salmonid species (Nehlsen 1994).

Results from the recent United States Forest Service (USFS) study document changes in low-flow channel widths within the South Umpqua Basin since 1937 (Dose and Roper 1994). Land management activities (road construction and timber harvest) have contributed to the changes in the channel characteristics. These changes in channel condition may have resulted in the observed decline of three of the four anadromous salmonid stocks occurring in the South Umpqua River Basin (Dose and Roper 1994).

The South Umpqua River once supported abundant populations of chinook and coho salmon, and steelhead and cutthroat trout. These species survived in spite of the naturally low streamflows and warm water temperatures that occurred historically within this subbasin (Nehlsen 1994). Currently, salmonid populations throughout the Pacific Northwest are declining. A 1991 status report identified a total of 214 native, naturally spawning stocks in the Pacific Northwest as vulnerable and at-risk of extinction (Nehlsen et al. 1991). According to this 1991 report, within the South Umpqua River, one salmonid stock is considered extinct, two stocks of salmonids are at-risk of extinction, and two stocks were not considered at-risk.

Historically steelhead runs in the South Umpqua River were strongest in the winter (Roth 1937). Currently, winter steelhead are considered to be the most abundant anadromous salmonid in the South Umpqua River (Nehlsen 1994). In 1937 Roth reported summer steelhead above the South Umpqua Falls. Summer steelhead are now considered to be extinct (Nehlsen et al. 1991).

Roth (1937) reported the principal run of chinook was in the late spring and summer. Presently, spring chinook runs are considered to be depressed by ODFW. Nehlsen et al. (1991) reported the spring chinook run at high risk of extinction. Fall chinook are considered to be healthy by ODFW (Nehlsen 1994).

Coho salmon were considered abundant in the South Umpqua River Basin in 1972 by the Oregon State Game Commission (Lauman et al. 1972). An estimated 4,000 fish spawned in the basin with the largest number of fish (1,450) spawning within Cow Creek. Presently, coho salmon in the South Umpqua River Basin are suffering the same declines as other coastal stocks. These declines may be due to several factors, including the degradation of their habitats, the effects of extensive hatchery releases, and overfishing (Nehlsen 1994). No coho salmon were sampled within the survey area (i.e., upper stream reaches of the South Umpqua River) during the 1937 survey. A subsequent study conducted during the summer of 1989 in Jackson Creek, a major tributary to the South Umpqua River, documented the common presence of coho salmon within this tributary (Roper et al. 1994). The documentation of coho salmon using Jackson Creek qualifies this species existence in the upper reaches of the South Umpqua River Basin. Coho salmon have been observed and sampled within the Cow Creek WAU as well.

Sea-run cutthroat are assumed to be depressed from historic levels. The information provided in the 1937 Roth report noted cutthroat trout were common and/or abundant throughout the stream segments surveyed in the Upper South Umpqua River Basin. There are limited historical records on cutthroat population size within the South Umpqua River.

The assumption that sea-run cutthroat trout abundance is currently below historic levels throughout the Umpqua Basin has been based upon the information provided by the fish counting station at Winchester Dam on the North Umpqua River. Between the years of 1947 and 1957 the North Umpqua River boasted runs of sea-run cutthroat trout averaging approximately 900 fish per year. The highest number return of 1,800 fish occurred in 1954 and the lowest return for the ten year period was 450 fish in 1949. In the late 1950s the sea-run cutthroat trout returns declined drastically.

The stocking of Alsea River cutthroat trout into the Umpqua system began in 1961 and was continued until the late 1970s. The stocking of this genetically distinct stock of trout into the Umpqua system has apparently led to compounding the problem for the sea-run cutthroat trout native to the Umpqua River Basin. Sea-run cutthroat trout returns have been extremely low since discontinuing the hatchery releases in the late 1970s. The levels of returns resemble prehatchery release conditions of the late 1950s, with an average return of <100 fish/year (ODFW 1994 - overhead packet). In 1992, no sea-run cutthroat returned to the North Umpqua River. In subsequent years, sea-run cutthroat trout numbers have been a total of 29 fish in 1993, 1 fish in 1994, 79 fish in 1995, and 81 fish in 1996.

According to the data available, the South Umpqua River appears to have supported a larger run of sea-run cutthroat trout than the North Umpqua River. In 1972, a total of 10,000 sea-run cutthroat trout were estimated within the South Umpqua River Basin. Sea-run cutthroat trout populations seemed to have the highest occurrence in those streams occupied by and accessible to coho salmon (Lauman et al. 1972). Today, these fish are limited to the upper portion of the mainstem South Umpqua River and Cow Creek, one of the major tributaries to the South Umpqua River. Warm water temperatures, lack of over-summering pool habitats, and low flows have precluded their use of the lower stream reaches in the basin (Nehlsen 1994).

The Umpqua Basin cutthroat trout has been listed by the National Marine Fisheries Service (NMFS) as an endangered species under the Endangered Species Act (ESA) of 1973, as amended. The National Marine Fisheries Service determined the Oregon Coast coho salmon Evolutionary Significant Unit did not warrant listing but may consider the Oregon Coast coho salmon to be a candidate species in 3 years (or earlier if warranted by new information) (Federal Register, Vol. 62, No. 87/Tuesday, May 6, 1997/Rules and Regulations). The West Coast steelhead has been proposed for listing by NMFS as a threatened species under the ESA. Two fish species, the Pacific lamprey (Lampetra tridentata) and the Umpqua chub (Oregonichthys kalawatseti) are on the United States Fish and Wildlife Service (USFWS) list as Species of Concern and are considered Bureau Sensitive species by the BLM (Manual 6840). All these species have been documented within the South Umpqua River.

Current anadromous fish distribution limits have been mapped, using GIS, for streams with documented barriers within the Cow Creek WAU (see Map 21). Distribution limits of anadromous and resident fish

are determined by the extent these fish are able to migrate upstream. Natural waterfalls, log or debris jams, beaver dams, and road crossings are potential barriers to fish movement and migration.

Aquatic habitat inventories have been completed for portions of Cow Creek and it's tributaries. The Cow Creek inventory covers about 70 miles of the approximate 1,284 total stream miles within the Cow Creek WAU (see the ODFW Aquatic Habitat Inventory Data Table in Appendix C). The inventories are used to describe the current condition of the aquatic habitat with a focus on the fish bearing stream reaches within a watershed.

The aquatic habitat inventory is not a fish distribution or fish abundance survey. The habitat inventory is designed only to survey physical habitat features. However, fish use and distribution information was noted in the habitat inventories. The stream surveyors noted fish use by visual observation only. Fish distribution surveys are currently underway on the Roseburg District BLM to determine the upper limits of resident fish use on BLM administered lands. Portions of the Cow Creek WAU were surveyed for resident fish use. The information available on the habitat condition and the distribution of fish species in the streams that have not been surveyed is in the form of personal communications and observations by ODFW and BLM biologists.

The data collected through the ODFW Aquatic Habitat Inventory can be used to analyze the components that may limit the aquatic habitat and the fishery resource from reaching their optimal functioning condition. The Habitat Benchmark Rating System is a method developed by the Umpqua Basin Biological Assessment Team (BAT team) to rank aquatic habitat conditions. The BAT team consists of fisheries biologists from the Southwest Regional Office of the ODFW, Coos Bay District BLM, Roseburg District BLM, Umpqua National Forest USFS, and Pacific Power and Light Company. The intention of the matrix designed by the BAT team is to provide a framework to easily and meaningfully categorize habitat condition. This matrix is not intended to reflect equality of the habitat condition of each stream reach, but is intended to summarize the overall condition of the surveyed reaches. The matrix is a four category rating system consisting of an *Excellent*, *Good*, *Fair*, or *Poor* rating.

Data from the ODFW Aquatic Habitat Inventories for Cow Creek WAU were analyzed to determine an overall aquatic habitat rating (AHR) for each stream. How the ratings correlate to the NMFS Matrix (see Appendix C) are shown in Table 16.

Each stream contains different limiting factors. Limiting factors for the fishery resource may include conditions where there has been a reduction in instream habitat structure, an increase in sedimentation, the absence of a functional riparian area, a decrease in water quantity or quality, or the improper placement of drainage and erosion control devices associated with the forest road network.

Map 21. Cow Creek Watershed Analysis Unit
Habitat Inventory Stream Reaches and Anadromous Fish Barriers

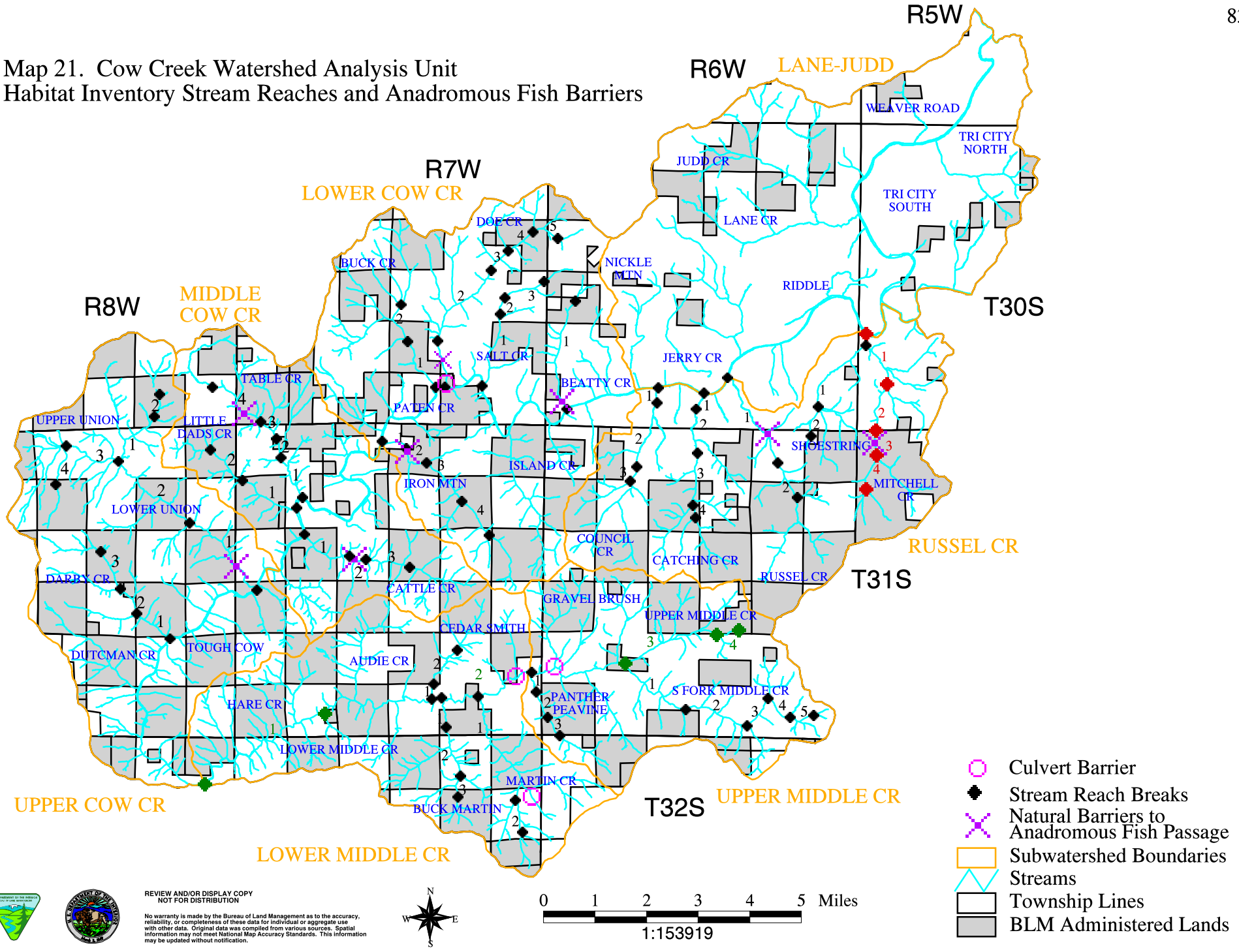


Table 16. Aquatic Habitat Ratings (AHR).

ODFW Aquatic Habitat Inventories	NMFS Matrix
Excellent or Good	Properly Functioning
Fair	At Risk
Poor	Not Properly Functioning

b. Current Stream Habitat Conditions

The Oregon Department of Fish and Wildlife (ODFW) conducted Aquatic Habitat Inventories on 22 streams in the Cow Creek WAU. Most of the 67 stream reaches identified in the inventories were rated as being fair (see the ODFW Aquatic Habitat Inventory Data Table in Appendix C). Two of the stream reaches were rated as being in good condition and seven of the reaches were rated as being in poor condition. Six of the seven stream reaches rated as poor were located in the Upper or Lower Middle Creek subwatersheds. The lack of Large Woody Debris seemed to be the limiting factor in most of the stream reaches. Excessive sediment, hardwood dominated riparian areas, the lack of large conifers available for future recruitment of the LWD, and the lack of shade contributing to higher stream temperatures were other limiting factors in some of the stream reaches.

The BLM administers land along approximately two miles of Martin Creek, a major tributary to Middle Creek. In 1984, five instream projects (gabion baskets) were placed in Martin Creek in the $SE^1/_4$, $SE^1/_4$, of section 35, in T31S, R7W. The structures provided pool habitat and recruited and maintained spawning gravels in the stream. These structures remained in place until the winter of 1996-1997 when flood events caused three of the five structures to fail. The spawning gravels that had been recruited were washed downstream and pools that had developed were lost. The two remaining structures were heavily damaged and are at high risk of failing. It is likely that these structures will not survive another series of flood events such as those that occurred during the winter of 1996-1997.

Restoration projects were constructed on Iron Mountain, Cattle, and Council Creeks in 1995. The Iron Mountain Creek culvert and the Council Creek culvert restoration projects were intended to improve the integrity of the existing culverts while providing juvenile and adult fish passage. The Cattle Creek culvert restoration project removed a dilapidated culvert and replaced it with a new bottomless arch structure. All of these projects have functioned as planned and have been successful in providing fish passage.

2. Wildlife

A variety of wildlife species use the different plant communities present in the WAU. The various vegetation types provide habitat to over 200 vertebrate species and thousands of invertebrate species. Fifty-six animal species are of special concern because they are federally threatened (FT), endangered (FE), Bureau Sensitive (BS), Bureau Assessment (BA), or Oregon State Sensitive species (see Table E-1 in Appendix E). In addition to these species, the Standards and Guidelines in the Record of Decision (ROD) for Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl (USDA and USDI 1994b), lists species to survey and manage for in Oregon, Washington, and California (USDA and USDI Appendix J2 1994a).

a. Threatened and Endangered Species

Five terrestrial species known to occur in the Roseburg District are legally listed as federally threatened (FT) or federally endangered (FE). These include the American Bald Eagle (Haliaeetus leucocephalus) (FT), the Marbled Murrelet (Brachyramphus marmoratus) (FT), the Northern Spotted Owl (Strix occidentalis caurina) (FT), the Peregrine Falcon (Falco peregrinus anatum) (FE), and the Columbian White-tailed Deer (Odecoilus virginianus leucurus) (FE). The northern spotted owl and the marbled murrelet are the only federally listed threatened or endangered species known to occur within the Cow Creek WAU.

1) The Northern Spotted Owl

Suitable forest habitats where spotted owls are located are known as spotted owl activity centers or master sites. In the Cow Creek WAU, the spotted owl is found in 63 master sites. This number represents the current and historical owl activity centers in the WAU. Of the 63 total sites, 49 sites are found on BLM lands (33 in the LSR and 16 in Matrix), 11 on private lands, and one on state municipal lands. Of the 32 potential sites on BLM lands (23 in the LSR and 9 on Matrix), twenty were occupied in 1996 (11 in the LSR and 4 on Matrix). Of the 10 potential sites on private land, five sites were active in 1996.

Only 32 activity centers on BLM may be occupied or potentially occupied at one time. The reason is an activity center may have one or more alternate location(s). Usually the area of these different alternate numbers overlap. The alternate sites are in a different location, such as a different drainage, ownership, or section, where subsequent nest trees have been located. In general terms, these nest areas form a forest grove where spotted owls use different nest trees during different years.

Habitat important to the spotted owl was identified by Roseburg District BLM biologists based upon on-the-ground knowledge, inventory descriptions of forest stands, and known characteristics of the forest structure. These habitats have been named Habitat 1 (HB1) and Habitat 2 (HB2). Habitat 1 describes forest stands that provide nesting, foraging and resting components. Habitat 2 describes forest stands that provide foraging and resting components but lack nesting components. Other areas not fitting into the HB1 or HB2 category and greater than 40 years old are considered dispersal habitat. Dispersal habitat refers

to forest stands greater than 40 years of age that provide cover, roosting, foraging, and dispersal components spotted owls use while moving from one area to another (Thomas et al. 1990, USDI 1992a; USDI 1994b). Tables 17 and 18 give the acres of HB1 and HB2 present in the Cow Creek WAU. Map 22 shows suitable habitat on BLM administered lands in the Cow Creek WAU.

Table 17. Spotted Owl Suitable Habitat Within The Cow Creek WAU.**

SPECIES	HABITAT 1	HABITAT 2	TOTALS
SPOTTED OWL	8,685	13,644	22,328
	39%	61%	100%

Table 18. Number of Acres and Percent of The Cow Creek WAU in Habitat 1 and 2 (Federal Land Only).

HABITAT 1	HABITAT 2	TOTAL FEDERAL LAND	TOTAL AREA IN COW CREEK WAU
8,685	13,644	42,447	118,339
7.3%	11.5%	35.9%	100%

** See text for definition of habitat 1 & 2.

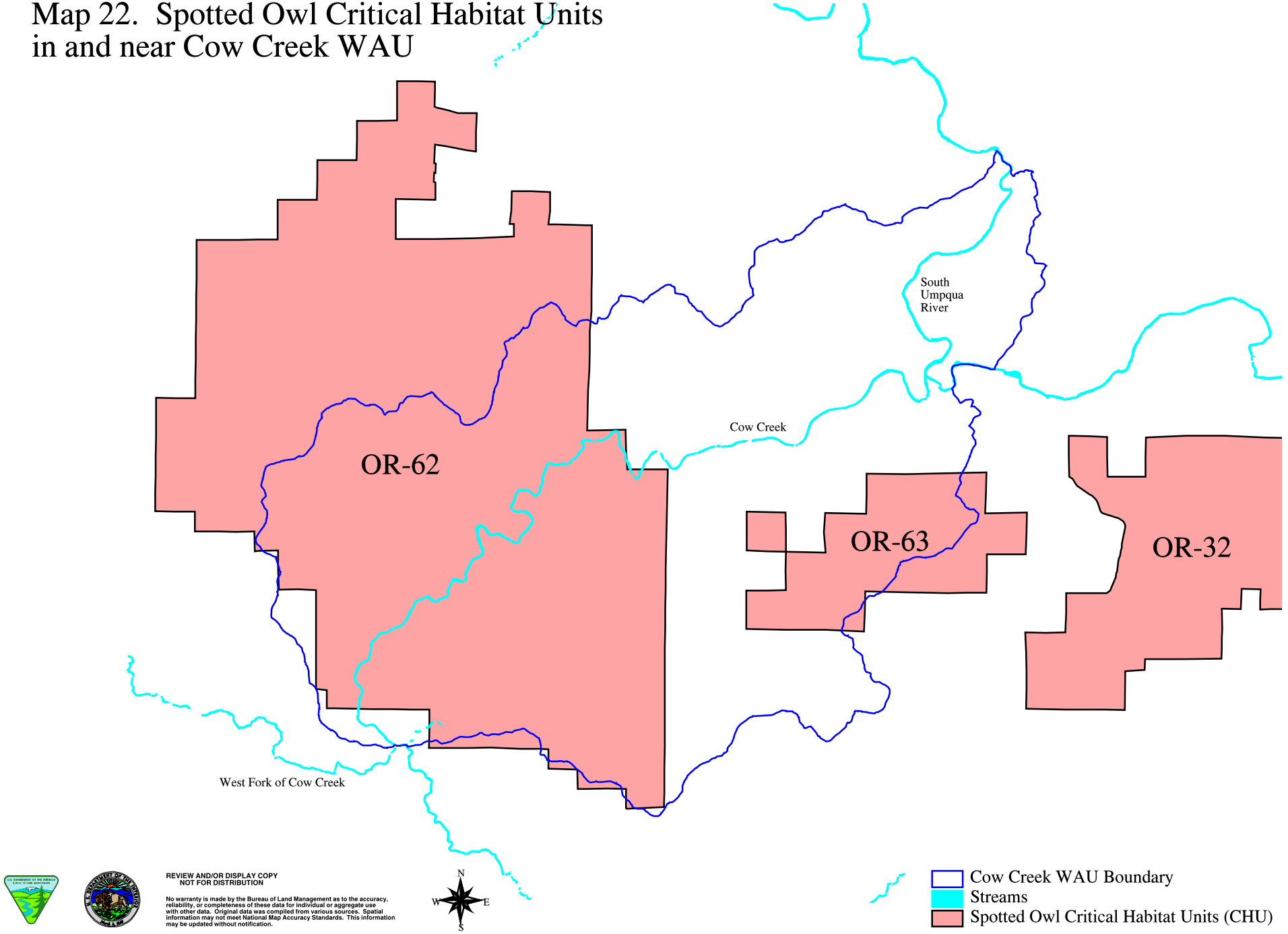
a) Dispersal Habitat

Another habitat component that can be measured is the amount of 50-11-40 acres. This number (50-11-40) refers to the condition where 50% of forested land within a quarter township is composed of 11 inch diameter trees with a minimum of 40% canopy closure (Thomas et al. 1990). This habitat condition is important for dispersal habitat outside of Late-Successional Reserves (LSR). Table 19 gives the acres of 50-11-40 present in the Cow Creek WAU in each quarter township that overlaps the WAU boundary. This data is available only for the eastern portion of the WAU on lands located outside the LSR area.

b) Critical Habitat for the Recovery of the Northern Spotted Owl

The Cow Creek WAU boundary overlaps two critical habitat units designated by the United States Fish and Wildlife Service for the recovery of the northern spotted owl (USDI 1992b). They are Critical Habitat Units CHU- OR-63 and CHU-OR-63 (see Map 23). Gross acres for these critical habitat units are 99,649 acres in CHU-OR-62 and 10,986 in CHU-OR-63. Approximately 50% of CHU-OR-62 is inside the Cow Creek WAU and about 70% of CHU-OR-63 is inside the WAU boundary. The portion of the Cow Creek WAU overlapping CHU-OR-62 has 14,174 acres of suitable spotted owl habitat (HB1 and HB2). The area overlapping with CHU-OR-63 has 3,810 acres of suitable habitat.

Map 22. Spotted Owl Critical Habitat Units in and near Cow Creek WAU



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Map 23. Suitable Spotted Owl Habitat Within Critical Habitat Units in the Cow Creek WAU

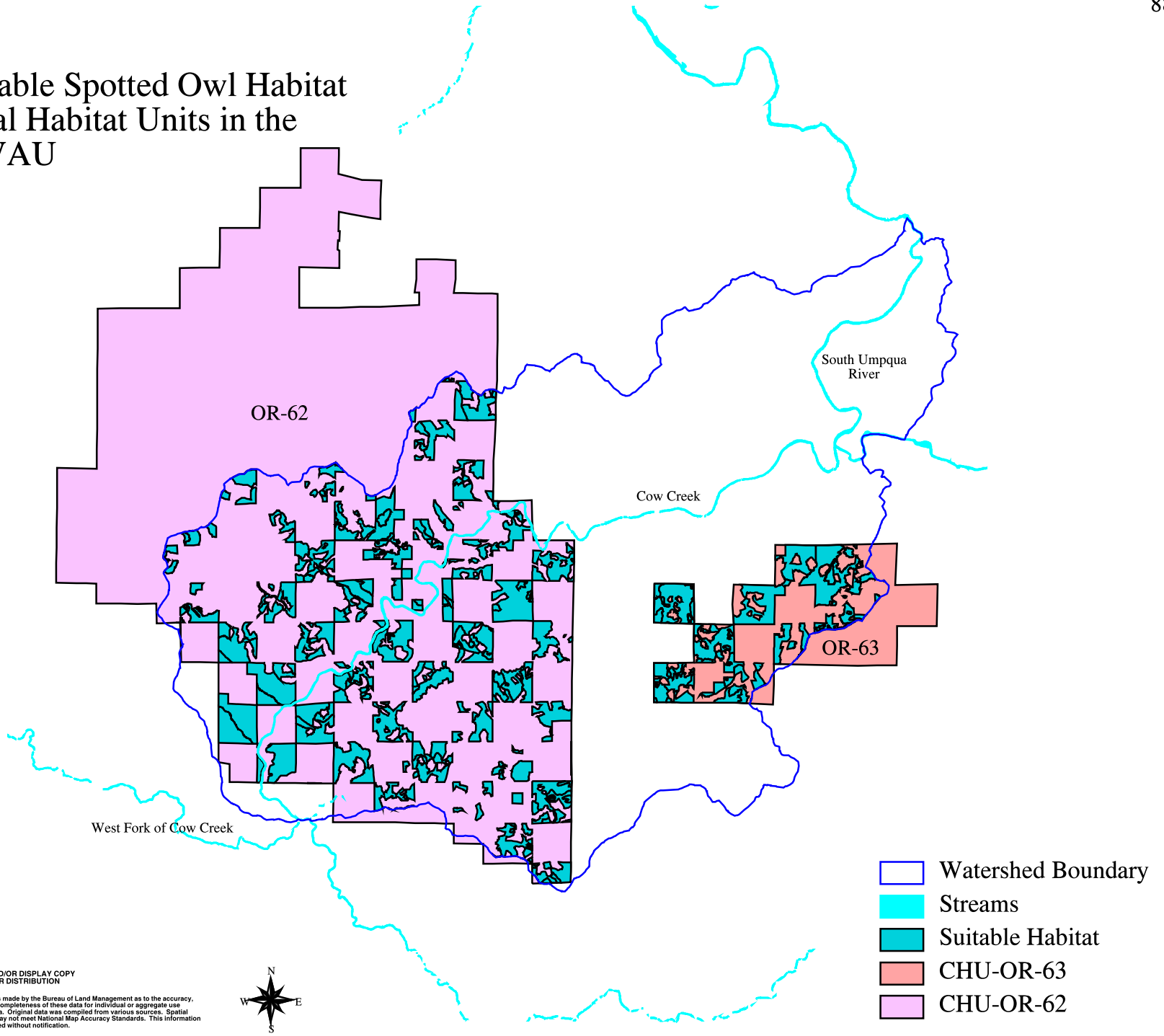

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Table 19. Acres of 50-11-40 Habitat In The Cow Creek WAU.

QUARTER TOWNSHIP	TOTAL AVAILABLE	1140 ACRES	1140 AVAILABLE	1140 %
29-05-NE	394	344	147	87
29-05-SW[A]	295	128	0	43
29-06-SE	649	143	0	22
30-05-NE[A]	1,948	1,265	291	65
30-05-NW	357	242	64	68
30-05-SW	181	114	24	63
30-06-NE	1,230	482	0	39
30-06-SE	40	40	20	100
30-06-NW	1,340	353	0	26
30-06-SW	942	281	0	30
31-05-NW	3,645	2,403	581	66
31-06-NE	2,996	2,049	551	68
31-06-SE	1,688	1,077	233	64
31-06-SW	2,317	1,361	203	59
31-06-NW	2,274	1,409	272	62
32-06-NE[A]	2,102	1,692	641	80
32-06-NW[A]	977	608	120	62

TOTAL AVAILABLE: Total forested acres including 50-11-40 acres.
1140 ACRES: Amount of 50-11-40 acres in the total forest acres.
1140 AVAILABLE: Number of acres above the 50% level of total acres available.
1140%: Percent of 50-11-40 acres in the township (1140 acres/total available).
A- Quarter township overlaps a small portion of BLM land in the WAU.

2) The American Bald Eagle

Historic distribution of the bald eagle included the entire northwestern portion of the United States (California, Oregon, Washington), Alaska, and western Canada. Bald eagle populations probably started declining in the 19th century but did not become noticeable until the 1940s (USDI 1986).

Throughout the North American range, drastic declines in bald eagle numbers and reproduction occurred between 1947 and the 1970s. In many places, the bald eagle disappeared from the known breeding range. The reason for this decline was the impact organochloride pesticide (DDT) use had on the quality of egg

shells produced by the eagles (USDI 1986). Bald eagle numbers probably declined on the Roseburg District because DDT was used in much of western Oregon from 1945 to the 1970s (Henny 1991). Other causes of eagle decline included shooting and habitat deterioration (Anthony et al. 1983). Historically, the removal of old growth forests near major water systems (e.g., South Umpqua River) contributed to habitat deterioration through loss of bald eagle nesting, feeding, and roosting habitat.

Information collected from yearly inventories (1971 to 1995) by Isaacs and Anthony (1995) of known bald eagle sites in Douglas County does not list any sites, nests, or territories within or near the Cow Creek WAU. Some forest stands along Cow Creek are considered potential bald eagle habitat. These stands are next to or within one mile of Cow Creek. Sporadic observations and reports of bald eagles along the South Umpqua River may represent migrating individuals. Midwinter surveys, from Days Creek to Melrose, have not detected bald eagles near the South Umpqua River-Cow Creek junction (Isaacs 1995). On occasion, bald eagles are observed during the Fall, Spring, or Winter but the eagles do not stay and do not appear to use the area as a long term wintering ground. To date there is no evidence of nesting by bald eagles in the Cow Creek WAU.

There are over 4,000 acres of mature and old-growth forest on BLM administered land within one mile of Cow Creek. The physical characteristics such as large, dominant trees with large limbs and broken tops, and close to water, often used by eagles for nesting, are present in some of these forest stands. About 1,823 acres of mature and old-growth forests within one mile of Cow Creek are potential bald eagle habitat (Map 24). The data used to determine potential habitat included diameter class and the stocking level of current stands. Evaluating the forest stands using spotted owl Habitat 1 (nesting characteristics) yielded 1,821 acres.

3) The Peregrine Falcon

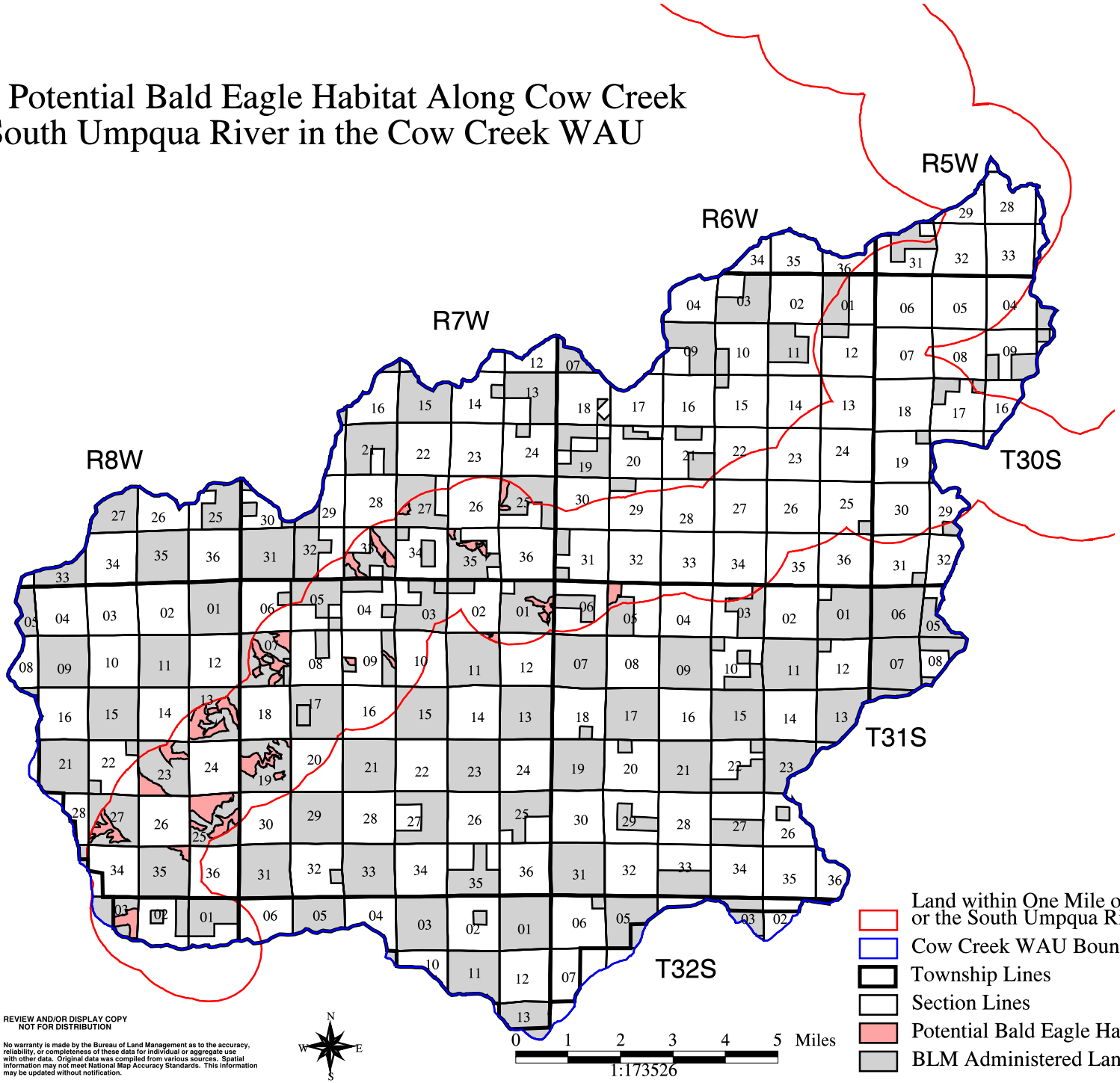
In Oregon, peregrine falcons were a "common breeding resident" along the Pacific coastline and were present in many areas including southwestern Oregon (Haight 1991). Peregrine falcon populations in the Pacific Northwest declined because of organochloride pesticide use, shooting, other chemicals (avicides, such as organophosphates) used to kill other bird species considered pests, and habitat disturbance (loss of wetlands, loss of fresh water marsh environments in interior valleys, and increased rural development) (Aulman 1991).

Several areas in the Cow Creek WAU have exposed bedrock due to erosion and other geological processes. An evaluation of aerial photographs and on-the-ground surveys determined rock outcrops or cliff habitats are present in the WAU. The potential exists for peregrine falcons to use these habitats. One habitat location known as PR2 is used by at least one adult peregrine falcon for perching. Surveys are continuing to document the status of this site.

4) The Marbled Murrelet

The marbled murrelet was listed as a threatened species in 1992 (USDI 1992c) and critical habitat for the recovery of the murrelet was designated in 1996 (Federal Register 61(102):26256-26278). The marbled murrelet is found in the Roseburg District. The middle of the Cow Creek WAU is 50 miles from the coast,

Map 24. Potential Bald Eagle Habitat Along Cow Creek and the South Umpqua River in the Cow Creek WAU



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which is considered to be the extent of suitable marbled murrelet habitat. Information about the biology and inland nesting sites indicates that the murrelet is unlikely to be found more than 50 miles from the Oregon Coast and surveys to detect murrelets are not required beyond this 50 mile zone. There are approximately 11,395 acres of suitable murrelet habitat in the Cow Creek WAU (see Map 25). Murrelet surveys have not been conducted in the Cow Creek WAU. All previous murrelet surveys in the South River Resource Area were conducted north of the Cow Creek WAU.

5) The Columbian White-tailed Deer

The Cow Creek WAU is outside the current and historical distribution range of the Columbian white-tailed deer (USDI 1983). The Columbian white-tailed deer is not present in the WAU. The known white-tailed deer population is restricted to an area northeast of Roseburg, approximately 20 air miles from the northern boundary of the Cow Creek WAU (USDI 1983).

b. Remaining Species of Concern

Other terrestrial animal species of concern, not threatened or endangered, may belong to the Federal Candidate, Bureau Sensitive, or Bureau Assessment category. On the Roseburg District 23 are Bureau Sensitive and 14 are Bureau Assessment species. See Appendix E for the species that occur on the Roseburg District.

Although there is information about the biology and habitat requirements of these Bureau Sensitive and Bureau Assessment species, population levels and current distribution are not available. Many of these animals use unique features such as ponds, seeps, caves, or talus found throughout the landscape and associated vegetation cover. In the Cow Creek WAU, the forest inventory of age classes is available, but the distribution patterns and abundance of unique habitats are not available at this time.

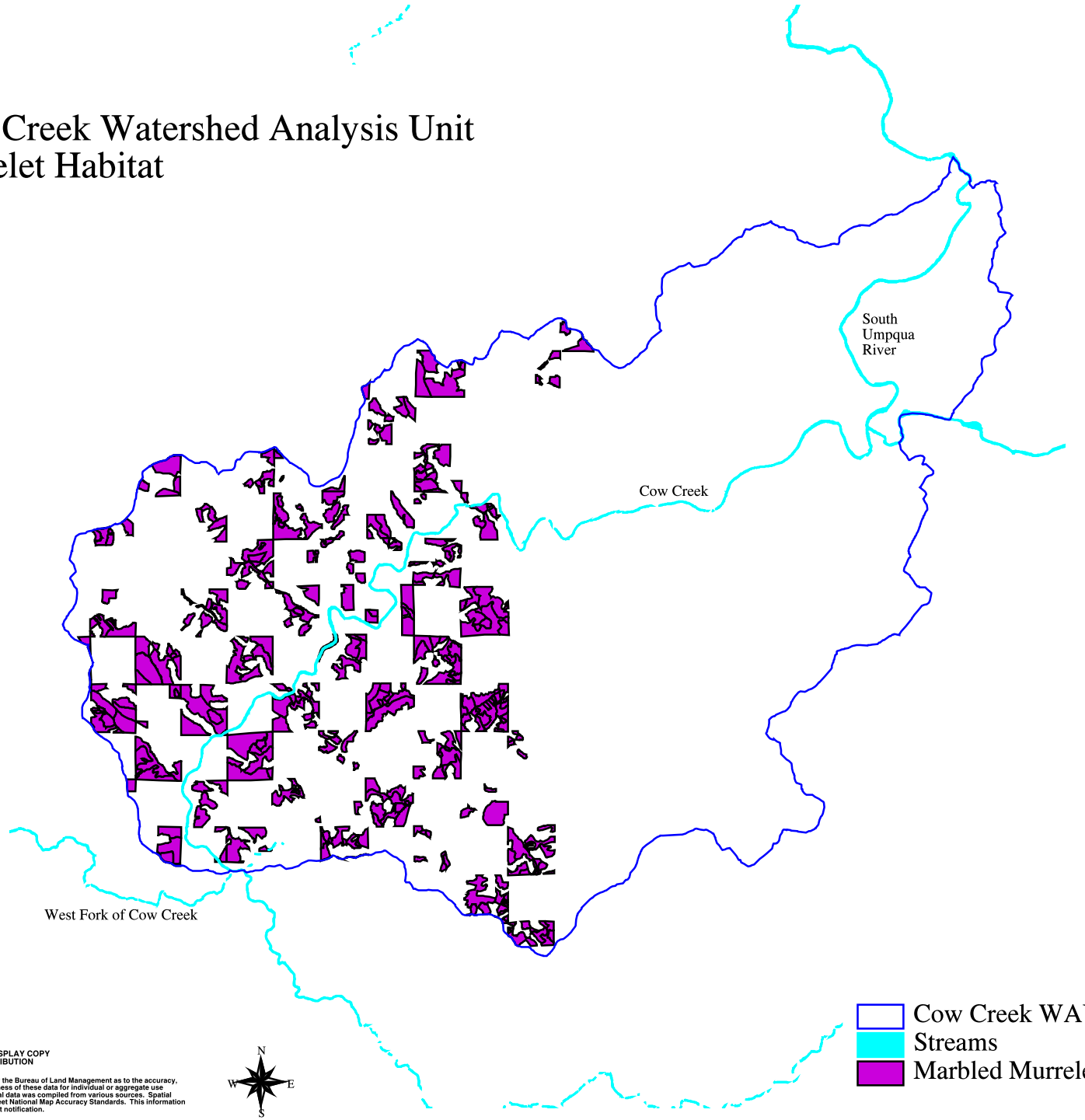
1) Mollusks

In western Oregon and Washington, over 150 species of land snails and slugs have been identified. Mollusks can be found at any elevation and in many different habitat types. Generally, snails and slugs avoid disturbed areas where habitat modification leads to the loss of moisture and increased exposure to solar radiation (Frest and Johannes 1993).

Over 200 species of aquatic mollusks have been documented in western North America. These species inhabit permanent or seasonal water bodies. Most freshwater mollusks prefer cold and clear streams with dissolved oxygen (DO) near saturation levels (Frest and Johannes 1993). In 1993, Frest and Johannes stated that 108 mollusk species (57 freshwater aquatic and 51 land) are known in the range of the spotted owl. Of these, 102 species are known or are likely to occur on federal lands.

In 1997, Frest and Johannes reported 46 mollusk species (17 land, 29 aquatic) were known to occur in Douglas County. An additional 75 species may be present. Thirty-one of these species were analyzed in

Map 25. Cow Creek Watershed Analysis Unit
Marbled Murrelet Habitat



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the SEIS ROD as sensitive taxons. Only four species of land snails and slugs present in Douglas County are listed in table C-3 of the SEIS ROD as requiring surveys prior to ground disturbing activities.

Approximately twenty mollusk survey plots were located in the Upper Cow Creek and Lower Middle Creek subwatersheds in 1997. Several species were common on most plots, including Ancotrema sportella, Haplotrema vancouverense, and undescribed species of Vespericola and Monadenia.

Surveys for terrestrial species located Prophysaon coeruluem, the blue-gray taildropper slug, which is a Survey and Manage species. The blue-gray taildropper slug was identified on four plots in Lower Middle Creek. The preferred habitat elements for this species are associated with relatively moist microsites, such as canopy closures greater than 70%, hardwoods, deep leaf litter, down logs, and ground vegetation such as sword fern and salal. The sites where the blue-gray taildropper slug was located are significantly drier type plant communities in the Tan Oak vegetative zone than the more typical site. Most of the sites did not contain hardwood species or sword fern, for example. However, the sites were generally located in the most moist microhabitats available in the vicinity, such as north slopes and small drainages with deep soils and shade.

In general, management for late seral characteristics tends to increase the moisture retention of an area. Increased tree species diversity (especially hardwood species), down woody debris amounts and soil depth in late seral stands produce a more favorable moisture regime at a given site and increases the abundance and diversity of mollusks present. Mollusk abundance increases the available nutrients at a site, increasing growth rates and moisture retention.

One Survey and Manage species thought to be present in the southern portion of the Roseburg district is Helminthoglypta hertleini, a medium-sized land snail that frequently is found in rocky talus habitats. The habitat type and range is similar to that of the Del Norte salamander, which is also a Survey and Manage species. Surveys for these two species could be conducted simultaneously. No known sites of Helminthoglypta hertleini had been found on the Roseburg District, as of July 1997.

2) Amphibians

An inventory of amphibians in the South River Resource Area was completed in 1994 (Bury 1995) and another inventory was conducted in 1997. These inventories document amphibian species in the area. The spotted frog is not expected to occur in the Cow Creek WAU and was not found during the 1994 inventory. Species like the Southern Torrent salamander (Rhyacotriton variegatus), western red-backed salamander (Plethodon vehiculum), Dunn's salamander (Plethodon dunni), and other regional species were documented in the WAU.

Amphibian species such as the northern red-legged frog, foothill yellow-legged frog, and clouded salamander use unique habitats often found within many vegetation types. Features like large down woody material, talus slopes, creeks, seeps, ponds, and wetlands are often used by amphibian species in

southwestern Oregon. Because these features are found in the Cow Creek WAU, these species are expected to occur here.

The Del Norte salamander (Plethodon elongatus), a Survey and Manage species, was located north of the Medford BLM District line in 1997. This is the first known Del Norte salamander site located in the South River Resource Area and the Roseburg BLM District. The Del Norte salamander uses forested talus habitat, rocky substrates in hardwood forests, and riparian areas. Other habitat features include cool moist conditions with moss and fern ground cover, lichen downfall, deep litter, and cobble dominated rocky substrates (IB-OR-96-161, Protocols for Survey and Manage Amphibians). The known range of the Del Norte salamander includes the southwest corner of the Cow Creek WAU but ongoing surveys may extend the range farther into the WAU.

3) Mammals

During the summer of 1994, a survey to identify the bat species present in the South River Resource Area was conducted by Dr. Steve Cross of Southern Oregon College in Ashland, Oregon. Bat species use unique habitats like caves, talus, cliffs, snags, and tree bark for roosting, hibernating, and maternity sites. In addition, bats use other unique habitats (ponds, creeks, and streams) for food and water. Special status bat species are present on the Roseburg BLM District and are expected to occur in the Cow Creek WAU.

Mammals like the white-footed vole and the red tree vole, which have geographic ranges that include the Roseburg BLM District, are expected to be present in the Cow Creek WAU. Information about the biology and life history of the white-footed vole is limited (Marshall 1991). This species is associated with riparian zones, woody materials, and heavy cover. Data suggests the white-footed vole is associated with mature forests (Marshall 1991). The red tree vole is an arboreal rodent, which lives inside the canopy of trees in Douglas-fir forests of Oregon and Northern California. It's primary food is the needle of the Douglas-fir. However, needles from Sitka spruce, western hemlock, and grand fir are also eaten by red tree voles (Huff et al. 1992). In 1997, the South River Resource Area began surveying for red tree voles in the Cow Creek WAU. The results will not be available until end of 1997 or the beginning of 1998. Reports from evaluating spotted owl pellets indicate the red tree vole is present in the Cow Creek WAU.

4) Northern Goshawk

Information about the northern goshawk is readily available (Marshall 1991). However, most of the work with this species was done east of the Cascades. Current geographic distribution suggests that the goshawk would not be expected to occur in most of the Roseburg BLM District. Observations recorded since 1984 show the goshawk is present north of the expected distribution range. In the early 1980s, two nest sites were found on the Roseburg BLM District but were not located within the Cow Creek WAU. Goshawks have been observed in the WAU but no nesting sites are known to be within the WAU.

5) Other Raptors

The Cow Creek WAU supports bird of prey species common to the region but estimates of local populations are not available. Raptor species are present and occur where suitable habitat is present.

Some information is available about ospreys. Osprey nesting habitat is present along Cow Creek. Osprey surveys along Cow Creek within the WAU documented five osprey territories but only one active nest during 1997. One osprey nest (unoccupied in 1997) is present on BLM lands in the Cow Creek WAU.

c. Neotropical Bird Species

Bird species that migrate and spend the winter in the various ecosystems found south of the North American Continent are considered neotropical bird species. Bird species that live on the North American Continent year round are resident birds. Oregon has over 169 bird species that are considered neotropical migrants. Over 25 species are documented to be declining in numbers (Sharp 1990).

Widespread concern for neotropical species, related habitat alterations, impacts from pesticide use, and other threats began in the 1970s and 1980s (Peterjohn et al. 1995). Population trends of neotropical migrants in Oregon show declines and increases. Oregon populations of 19 bird species show statistically significant declining trends while nine other bird species show significant increasing trends (Sharp 1990). Including all species that show declines, increases, or almost statistically significant trends as a proportion of routes there are 33 decreasing species and 12 increasing species in Oregon (Sharp 1990).

During 1993, 1994, 1995, and 1996, neotropical birds were captured and banded, and habitat evaluations were conducted in the South River Resource Area. However, none of this work was done inside the Cow Creek WAU. Results from the banding station two miles from the WAU shows that neotropical bird species use the available habitat types during migration and the breeding season.

The Cow Creek WAU supports populations of neotropical species. Given the different vegetation zones within the Cow Creek WAU, the WAU may provide habitat for more neotropical species than those species located at the banding station. The unique and diverse habitats found in the Interior Valley vegetative zone have hardwood, shrub, and conifer species not found at the banding station that function as habitat for many neotropical birds.

d. Big Game Species (Elk and Deer)

Historically, the range of Roosevelt Elk extended from the summit of the Cascade Mountains to the Oregon coast. In 1938, the elk population in Oregon was estimated to be 7,000 (Graf 1943). Elk numbers and distribution changed as people settled in the region. Over time, elk habitat areas shifted from the historical distribution to "concentrated population centers which occur as islands across forested lands of

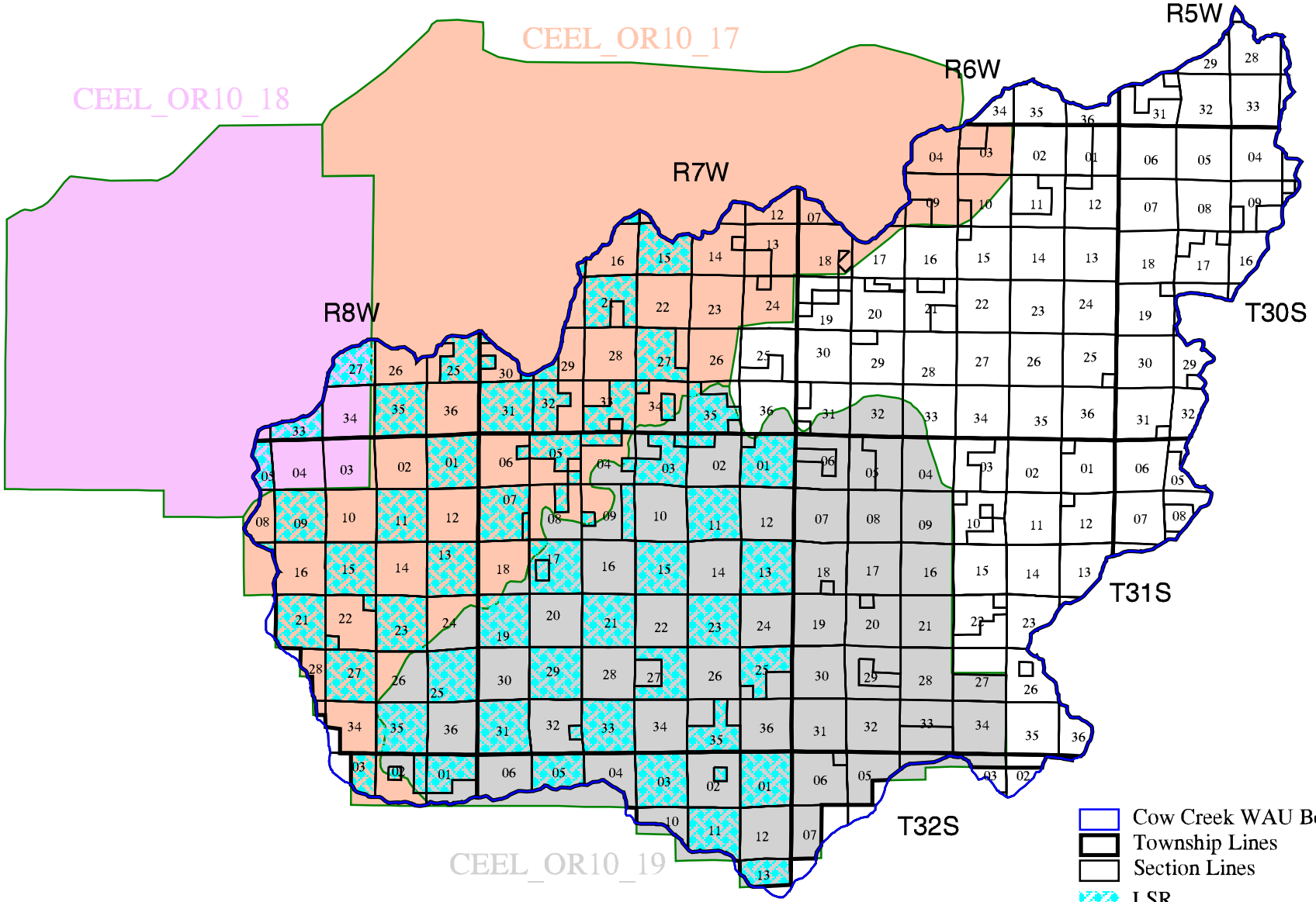
varying seral stages" (South Umpqua Planning Unit 1979). Information about the historical distribution of elk within the Cow Creek WAU and the equivalent Dixon management unit (set by ODFW) is not available. Given the increased number of people, road construction, home construction, and timber harvesting in the area, it is suspected that elk numbers have declined as reported in other parts of the region (Brown 1985).

The Cow Creek WAU includes portions of three elk management areas identified in the Roseburg District ROD/RMP (USDI 1995). However, management direction for these three elk management areas was not discussed in the RMP. The elk management areas are shown on Map 26. Communication with the Oregon Department of Fish and Wildlife identified this area as lacking current elk population estimates. One or two elk herds are known to use the Middle Creek portion of the WAU. The quality of elk habitat in these management areas was evaluated in the Proposed Roseburg District Resource Management Plan/EIS (USDI 1994b). Using the Wisdom model (Wisdom et al. 1986), cover quality, forage quality, and road density indices were calculated. All three indices were below the minimum levels considered important for optimum use by elk in the Cow Creek WAU. The habitat indices are only guidelines considering the quality of the habitat as it relates to roads, forage, or hiding cover.

The current, as well as historic, black-tailed deer range is throughout Oregon. During the logging that occurred after WWII, suitable young seral age stands (less than 20 years old) were abundant and black-tailed deer populations increased to the point that liberal hunting seasons were permitted. Overall, black-tailed deer numbers remained stable through the late 1970s in the South Umpqua Planning Unit (South Umpqua Planning Unit 1979). Creation of early seral stands as a result of timber harvesting benefitted deer and elk as a byproduct and not as part of a specific management plan for these game species.

Current numbers of Roosevelt Elk and black-tailed deer in the Cow Creek WAU are not available (Personal communication from ODFW). Both species are present and use similar habitats. Elk and deer forage for food in open areas where the vegetation includes grass-forb, shrubs, and open sapling communities. Both species use a range of vegetation age classes for hiding. This hiding component is provided by large shrub, open sapling, closed sapling, and mature or old growth forest communities (Brown 1985).

Map 26. Elk Management Areas in the Cow Creek WAU



Cow Creek WAU Boundary
Township Lines
Section Lines
LSR
Elk Management Areas
CEEL_OR10_17
CEEL_OR10_18
CEEL_OR10_19

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0 1 2 3 4 5 6 Miles

1:178564

3. Plants

Field surveys have been conducted for Special Status Plants on portions of the Cow Creek WAU. Eight Special Status Plants have been documented in the WAU.

Allium bolanderi (Bolander's Onion); Assessment Species
Allium bolanderi grows on stony slopes and gravelly flats on serpentine soils below 3,000 feet. Distribution ranges from Douglas County, Oregon to Lake County, California.

Calochortus coxii (Crinite Mariposa Lily); Bureau Sensitive Species
Calochortus coxii is a newly discovered and described species known only to exist along a twelve mile serpentine ridge system between Dodson Butte and Riddle in Douglas County, Oregon. Calochortus coxii is a distinct, showy, perennial forb in the lily family that blooms from late June to July. Calochortus coxii is restricted to serpentine soils. It is found in a number of different habitats ranging from woodlands to open grasslands. Currently only two real populations exist, separated by Interstate 5 (Fredricks 1989). A Conservation Strategy is being developed to identify and schedule management actions to remove or limit threats and provide for the long term survival of Calochortus coxii.

Cypripedium montanum (Mountain Lady's Slipper); Tracking and "Survey and Manage" Species
Cypripedium montanum populations are small and scattered; less than 20 are extant west of the Cascades. Small populations may reflect the slow establishment and growth rate of this species. Cypripedium montanum seems to persist in areas that have been burned. This species ranges from Southern Alaska and British Columbia south to Montana, Idaho, Wyoming, Oregon, and California. Survival of the species may depend on protection of known populations and development of a conservation plan (USDA and USDI SEIS Appendix J2 1994a).

Dichelostemma ida-maia (Firecracker Plant); Tracking Species
Dichelostemma ida-maia grows in open woods, grassy hillsides, and roadsides at elevations between 1,000 and 4,000 feet from Douglas County, Oregon south through the Siskiyous into California, where it is more common. It has been sighted in clearcuts, roadcuts, and areas impacted by fire.

Mimulus douglasii (Douglas' Monkey Flower); Assessment Species
Mimulus douglasii grows in moist soil or gravelly places, usually on serpentine soils, in Douglas, Curry, Josephine, and Jackson Counties of southwest Oregon south to central California.

Pellaea andromedaefolia (Coffee Fern); Assessment Species
Pellaea andromedaefolia is a fern that occurs on dry rock outcrops, mostly in the open, but at times along shaded stream banks below 4,000 feet elevation. Distribution ranges from Lane County Oregon south to Baja, California.

Phacelia verna (Spring Phacelia); Tracking Species
Phacelia verna grows on mossy sparsely vegetated rock outcrops mostly in the Umpqua River Valley. It has been observed to repopulate an area after a low intensity fire.

Polystichum californicum (California Shield Fern); Assessment Species
Polystichum californicum grows on rock outcrops beneath forest canopies or on slopes at low and mid elevations. Distribution ranges from British Columbia south to Santa Cruz County, California.

Other plant species to consider include "Protection buffer" and "Survey and Manage" species that are suspected to occur in the Cow Creek WAU. "Protection buffer" species suspected to occur in the Cow Creek WAU include the Bryophytes Brotherella roellii, Buxbaumia viridis, Rhizomnium nudum, Schistostega pennata, Tetraphis feniculata, and Ulota meglospora, and the Fungus Sarcosoma mexicana. "Survey and Manage" plant species suspected to occur in the Cow Creek WAU are listed in Table F-1 in Appendix F.

Noxious Weeds

Noxious weeds have been identified in the Cow Creek WAU. The encroachment of noxious weeds has steadily reduced natural resource values. Noxious weed invasions dramatically affect native plant communities, reducing the abundance and distribution of native plants (Bedunah 1992).

The intent of an integrated weed management program is to implement a strategy that will facilitate maintenance and restoration of desirable plant communities and healthy ecosystems. The Bureau of Land Management has an agreement with the Oregon Department of Agriculture (ODA) where locations of noxious weed invasions are identified and monitored by the BLM and control measures are administered by ODA.

The following goals are important in the implementation of integrated weed management:

-Inventory by species
-Identification of potential invaders
-Monitoring
-Prioritization of noxious weed species
-Habitat management and restoration
-Revegetate bare soil following disturbance
-Develop rock source management plans
-Keep records of roads surfaced with rock that may contain noxious weed seed.

The following (Target) noxious weeds have been documented in the Cow Creek WAU.

Yellow Starthistle (Centaurea solstitialis) has been designated as a Target weed species by ODA. Because of the economic threat to the state of Oregon, action against these weeds would receive priority. Yellow Starthistle is native to dry open habitats in Southern Europe. A single Yellow Starthistle plant can produce up to 150,000 seeds under optimum conditions. The ODA would control documented invasions of Yellow Starthistle. The area would be monitored by BLM for resurgence.

Rush Skeletonweed (Chondrilla juncea) has been designated as a Target weed species by ODA. Because of the economic threat to the state of Oregon, action against these weeds would receive priority. Rush Skeletonweed grows in rangelands and along roadsides. The ODA would control documented invasions of Rush Skeletonweed.

V. Interpretation

A. Vegetation

Changes in age class distribution over the past 60 years are shown on the Cow Creek Watershed Analysis Unit 1936 and 1997 Age Class Distribution Maps (Maps 4 and 7). The main causes for the difference between conditions are land ownership, mining, management activities, timber harvesting, and natural disturbances. The checkerboard land ownership and timber harvesting has fragmented most of the WAU in the last 50 years. Timber harvests began in the late 1940s, shaping the vegetative structure and pattern to the present day. Historically, before intensive harvesting began, stand replacing fires were the major disturbance and concentrated the seral stages in larger contiguous blocks. Table 20 shows the number of acres within the Cow Creek WAU that BLM management activities have affected in the past 50 years.

Table 20. Recorded BLM Management Activities In The Cow Creek WAU Since 1946.

	GFMA	CONNECTIVITY	LSR	TOTAL
	acres	acres	acres	acres
Clearcut	1,711	963	4,361	7,035
Partial Cut	0	63	73	136
Overstory Removal	39	0	565	604
Precommercial Thinning	586	573	864	2,023
Fertilization	378	357	883	1,618
Broadcast Burn	858	462	3,015	4,335
Pile and Burn	0	45	52	97

Although private lands are a major component of this Watershed Analysis Unit (64%), the focus of the interpretation will be on BLM administered lands. Private lands are in a constant state of change and although stands greater than 30 years old will continue to be harvested, we cannot predict the timing or amount of harvest.

Bureau of Land Management administered lands available for intensive forest management are those lands outside of Late-Successional Reserves, Riparian Reserves, and other areas withdrawn from timber harvesting or reserved areas. The WAU contains approximately 7,166 acres (17%) of BLM administered lands that are available for intensive forest management (see Table 21). Silvicultural practices including prescribed fire could be used to obtain desired vegetation conditions in special habitats areas. Based on the age class of the various stands and Land Use Allocation, the stands would be available for the following treatments.

Table 21. Vegetation Outside of Reserves in Cow Creek WAU.

	Nonforest		Early Seral (0 to 30 Years Old)		Mid Seral (31 to 80 Years Old)		Late Seral (80 + Years Old)		
Area	Acres	%	Acres	%	Acres	%	Acres	%	Total
Jerry Creek	0	0	67	47	0	0	75	53	142
Judd Creek	0	0	174	58	89	30	36	12	299
Lane Creek	0	0	137	88	7	4	12	8	156
Nickle Mountain	0	0	0	0	0	0	10	100	10
Riddle	0	0	0	0	0	0	0	0	0
Tri City North	7	5	61	41	2	1	79	53	149
Tri City South	0	0	0	0	9	7	123	93	132
Weaver	0	0	0	0	1	20	4	80	5
Lane-Judd Subwatershed	7	1	439	49	108	12	339	38	893
Beatty Creek	0	0	2	3	0	0	60	97	62
Buck Creek	0	0	0	0	0	0	0	0	0
Doe Creek	3	1	200	65	9	3	96	31	308
Iron Mountain	0	0	0	0	0	0	0	0	0
Island Creek	0	0	140	54	0	0	121	46	261
Paten Creek	0	0	0	0	0	0	0	0	0
Salt Creek	0	0	144	68	0	0	68	32	212
Lower Cow Creek Subwatershed	3	0	486	58	9	1	345	41	843
Cattle Creek	0	0	0	0	0	0	0	0	0
Little Dads Creek	0	0	0	0	0	0	0	0	0
Table Creek	0	0	0	0	0	0	0	0	0
Middle Cow Creek Subwatershed	0	0	0	0	0	0	0	0	0
Darby Creek	0	0	0	0	0	0	0	0	0
Dutchman Creek	0	0	25	33	10	13	41	54	76
Lower Union	0	0	0	0	0	0	0	0	0
Tough Cow	0	0	0	0	0	0	0	0	0
Upper Union	0	0	0	0	0	0	0	0	0
Upper Cow Creek Subwatershed	0	0	25	33	10	13	41	54	76

Table 21. Vegetation Outside of Reserves in Cow Creek WAU.

	Nonforest		Early Seral (0 to 30 Years Old)		Mid Seral (31 to 80 Years Old)		Late Seral (80 + Years Old)		
Area	Acres	%	Acres	%	Acres	%	Acres	%	Total
Audie Creek	0	0	0	0	0	0	0	0	0
Buck Martin	1	7	13	93	0	0	0	0	14
Cedar Smith	0	0	0	0	0	0	0	0	0
Hare Creek	0	0	0	0	0	0	0	0	0
Lower Middle Creek	0	0	0	0	0	0	0	0	0
Martin Creek	0	0	7	12	4	7	46	81	57
Lower Middle Creek Subwatershed	1	1	20	28	4	6	46	65	71
Gravel Brush	0	0	109	38	21	7	158	55	288
Panther Peavine	0	0	182	34	10	2	339	64	531
South Fork Middle Creek	0	0	173	35	54	11	264	54	491
Upper Middle Creek	8	2	84	23	17	5	264	71	373
Upper Middle Creek Subwatershed	8	0	548	33	102	6	1,025	61	1,683
Catching Creek	0	0	93	12	147	19	529	69	769
Council Creek	0	0	299	46	36	6	313	48	648
Mitchell Creek	6	1	84	9	319	34	536	57	945
Russel Creek	0	0	254	26	233	23	505	51	992
Shoestring	0	0	43	17	2	1	201	82	246
Russel Creek Subwatershed	6	0	773	21	737	20	2,084	58	3,600
Cow Creek Watershed Analysis Unit	25	0	2,291	32	970	14	3,880	54	7,166

1. GFMA

Early Seral (0 to 30 years old): The early seral stage contains approximately 3,037 acres, of this about 1,376 acres are in Riparian Reserves. Regeneration is usually achieved by planting following site preparation. A mixture of tree species appropriate to the site would be planted. In addition, genetically selected stock should be planted when available. Treatments to reduce competition from undesired species may be necessary for the trees to become established. Precommercial thinning may be prescribed to maintain stand vigor and control species composition and stand density. Fertilizing thinned stands may be necessary to temporarily increase stand growth, improve tree vigor, and reduce insect and drought related mortality. Fertilizer is usually applied at a rate of 200 pounds of nitrogen per acre in the form of a urea based prill. Pruning young stands improves wood quality through the production of clear wood in a shorter time than would occur without the action. Pruning should be done on high productivity sites to improve wood quality through the production of clear wood. Pruning young stands of sugar pine may reduce the risk of mortality caused by white pine blister rust. The risk of mortality due to white pine blister rust can be reduced by pruning sugar pine to a height of 10 feet.

Mid Seral (31 to 80 years old): The mid seral stage contains approximately 697 acres, of this about 331 acres are in Riparian Reserves. In the Cow Creek WAU commercial thinning would generally be programmed for stands between 50 and 80 years old. Areas with a high site productivity may include 40 year old stands. Thinning treatment intervals range from 10 to 30 years, varying by site class, with poor sites having longer intervals. The location of potential commercial thinning stands are shown by age on the Cow Creek WAU BLM Age Class Distribution Map.

Stands considered suitable for commercial thinning generally have a closed canopy, dead lower limbs, dead standing and down trees, and slowed tree growth. Mortality in the suppressed and intermediate crown positions is occurring where stocking (trees per acre) is the highest. This mortality is expected given the high relative density of the stands (a relative density above .56 is the lower limit of competition mortality). The same relative density is associated with the beginning of density-related mortality and with a 40% live-crown ratio (Long 1985 and Daniel et al. 1979). Average tree vigor is reduced when live-crown ratios fall below 40% (Dean and Baldwin 1993). In order to promote tree survival and growth and Aquatic Conservation Strategy objectives, highly stocked riparian areas should be to thinned. Entering riparian areas would increase or maintain tree growth and vigor, reduce the risk of insect outbreaks, maintain the existing diversity, and allow attaining large trees in a shorter time. Any activities within Riparian Reserves would be to acquire desired vegetative characteristics meeting Aquatic Conservation Strategy objectives.

Late Seral (81 years old and older): The late seral stage contains approximately 4,870 acres, of this about 1,997 acres are in Riparian Reserves. General Forest Management Area objectives are to provide a sustainable supply of timber and other forest commodities. Regeneration harvests would be programmed at culmination of mean annual increment (CMAI) for stands 60 years old or older. Culmination of mean annual increment is at 80 to 110 years old on the average for this WAU. The modified reserve seed tree method of harvest removes the majority of a stand in a single entry except for a small number of trees; six

to eight conifer trees per acre. In addition coarse woody debris and snags would be retained to meet management objectives.

2. Connectivity

Early Seral (0 to 30 years old): The early seral stage contains approximately 1,508 acres, of this about 800 acres are in Riparian Reserves. Treatments prescribed for this age class would be the same as those described for Early Seral stands in GFMA.

Mid Seral (31 to 80 years old): The mid seral stage contains approximately 1,248 acres, of this about 436 acres are in Riparian Reserves. Treatments applied in this age class would mainly be density management, such as commercial thinning. Thinning would harvest merchantable trees that would be lost due to mortality. Thinning in Riparian Reserves would occur with the specific objective of hastening the restoration of large conifers to areas where they are currently deficient.

Late Seral (81 years old and older): The late seral stage contains approximately 4,894 acres, of this about 2,322 acres are in Riparian Reserves. Harvest in stands under 120 years of age would emphasize density management. Regeneration harvest resembling a shelterwood cut leaving 12 to 18 green conifer trees per acre greater than 20" in diameter would be programmed using a 150 year rotation. Management direction for Connectivity Blocks are to maintain 25 to 30 percent of each block in late-successional forest.

3. Late-Successional Reserve

Late-Successional Reserves are to be managed to protect and enhance late-successional and old-growth forest ecosystem conditions. Stand management in LSRs should focus on stands that have been regenerated following timber harvesting or stands that have been thinned. There are approximately 8,054 acres (31%) in the LSR that are currently not in a late-successional or old-growth condition, but are capable of developing into those conditions. The South Coast - Northern Klamath Late-Successional Reserve Assessment (LSRA), when it is completed, should be consulted to help facilitate implementation of appropriate management activities for the LSR and assure that these activities meet LSR standards and guidelines.

Early Seral (0 to 30 years old): Planting conifers or hardwoods may be needed to reach late-successional conditions or protect site quality. Maintenance of the stand through treatments such as mulching, manual brush cutting, or animal damage control may be necessary to ensure tree survival. Precommercial thinning and fertilization may be prescribed to develop diameter and biomass retention. The main goal would be to reduce stocking and increase tree growth to keep the trees in a vigorous healthy condition. This would allow flexibility for future stand management. At least one other treatment would be necessary to place the stand on a path to attain other characteristics of late-successional forests.

Following precommercial thinning there would be approximately 170 to 220 trees per acre remaining. The species mix retained should be similar to that of late-successional and old-growth forests within that vegetative zone for both hardwoods and conifers. Depending on the site specific characteristics, all hardwoods could be maintained. Some spouting hardwood trees, such as madrone, could be thinned back

to one dominant stem. No trees over 8" dbh would be cut, to maintain the largest trees and any residuals. Spacing of the leave trees should be variable. Areas of unthinned trees should be maintained for spatial diversity, but no more than 5% of the stand would remain in this unthinned condition.

In the next 3 to 5 years, there will be about 655 acres to precommercial thin in the Lower Middle Creek Subwatershed. These areas are shown on the Cow Creek Watershed Analysis Unit BLM Age Class Distribution Map (Map 6). The large concentrated acreage in the 10 year age class is a result of the Buck Creek Fire in 1987.

Mid Seral (31 to 80 years old): Treatments applied in this age class would mainly be density management, such as commercial thinning. Commercial thinning stands would accelerate the development of large trees and species diversity creating late-successional conditions and reducing the risk of a large-scale disturbance. The REO has exempted from further review certain commercial thinnings that meet the following conditions. Following the completion of an LSR Assessment, density management projects meeting these criteria could be implemented. At least ten percent of the stand should remain in unthinned patches. Three to 10 percent of the stand should be in heavily thinned patches of less than 50 trees per acre or in openings. Selection of leave trees would not be based on leaving the healthiest, best formed trees. A percentage of the leave trees would be in culls or broken top green trees. The trees removed would generally be in the intermediate and suppressed crown classes, though a range of diameters of the leave trees would be favorable. A species mix similar to that of late-successional and old-growth forests within that vegetative zone would be maintained for both hardwoods and conifers. All remnant snags would be retained where they do not present a safety problem. Areas of unthinned trees around the snags would facilitate their retention and lesson the safety concern. Spacing of leave trees would be variable. Depending on the individual stand characteristics green trees may need to be felled and left on the ground to accomplish a down wood objective.

Late Seral (81 years old and older): Timber harvesting in stands greater than 80 years old is not allowed, except under certain conditions such as reducing hazards, salvaging dead trees or trees not expected to live following a large-scale disturbance, and activities to reduce the risk of a large-scale disturbance (USDA and USDI 1994b). Treatments should protect more acres than are treated.

Management direction from the Roseburg District RMP states that 15 percent of all federal lands, considering all Land Use Allocations, within fifth field watersheds should remain in late-successional forest stands. The Cow Creek WAU is a fifth field watershed. Approximately 53 percent (22,388 out of 42,447 acres) of the Cow Creek WAU is in stands 80 years old or older and located in reserved or withdrawn land use allocations (LSR, Riparian Reserve, Owl Core Area, or TPCC Withdrawn). These areas would be expected to remain in late-successional forest conditions.

Matrix lands in the Cow Creek WAU are to be managed for timber production to help meet the Probable Sale Quantity (PSQ) established in the Roseburg District RMP. Table 22 shows acre estimates of GFMA and Connectivity Land Use Allocations to be harvested per decade.

Table 22. Acres of Proposed Harvest (per decade) in Matrix in the Cow Creek WAU.

Subwatershed	GFMA (Acres per decade)	Connectivity (Acres per decade)
Lane - Judd	46	6
Lower Cow Creek	146	0
Lower Middle Creek	0	0
Middle Cow Creek	0	0
Russel Creek	197	139
Upper Cow Creek	8	0
Upper Middle Creek	79	79

Approximately 700 acres per decade are expected to be harvested on BLM administered lands within the Cow Creek WAU. This would be about ten percent of the 7,165 acres considered available for harvesting within the WAU. Although, less than two percent of the Cow Creek WAU would be harvested per decade. All of the stands in Matrix greater than 80 years old would be harvested in approximately 55 years, at a rate of 700 acres per decade.

A rating system was developed to determine which subwatersheds were considered most appropriate for planning timber harvesting activities. The rating was based on individual resource values for wildlife, fisheries, and hydrology (see Table 23). A rating of where to harvest based on timber concerns is also listed in Table 23. The rating system defined a rating of 1= first place, 2 = second place, 3 = third place, and 4 = last place to go for timber harvesting. The system was used to develop a 10 year timber sale plan scenario.

Table 23. Timber Harvesting Priority Ratings of Subwatersheds in the Cow Creek WAU by Individual Resource Concerns.[1]

Timber	Wildlife	Fisheries	Hydrology
2. Russel Creek	1. Lane-Judd	1. Lane-Judd	1. Lane-Judd
3. Upper Middle Creek	4. Russel Creek	1. Russel Creek	1. Russel Creek
4. Lane-Judd	4. Lower Cow Creek	3. Lower Cow Creek	2. Lower Cow Creek
4. Lower Cow Creek	4. Upper Cow Creek	4. Upper Cow Creek	2. Upper Cow Creek
4. Upper Cow Creek	4. Middle Cow Creek	4. Middle Cow Creek	3. Middle Cow Creek
4. Middle Cow Creek	4. Upper Middle Creek	4. Upper Middle Creek	4. Upper Middle Creek
4. Lower Middle Creek	4. Lower Middle Creek	4. Lower Middle Creek	4. Lower Middle Creek

1. Numbers indicate how Subwatersheds were ranked by Individual Resources in the Ten Year Plan, which ranks all of the Subwatersheds in the South River Resource Area. Subwatersheds in a column with the same numbers indicate they were rated the same priority.

The rankings for timber harvesting follow closely with the rankings by individual resources with the exception of Upper Middle Creek subwatershed. The other resource concerns suggest other subwatersheds should be considered before planning or scheduling regeneration harvests in the Upper Middle Creek subwatershed.

B. Fire and Fuels Management

Treatments of natural fuels may be planned around areas of high recreation use, along heavily traveled road corridors, or even on certain specific forest stands where needed to reduce risks of wildfire, improve habitat of special status plants, or improve forest health. Prescribed underburning, pile burning, and manual or mechanical treatments could be used on areas where wildfire exclusion has resulted in natural fuel accumulations considered unnatural and is considered to be a high risk due to wildfire. Extensive fuels management treatments are difficult to justify, economically, for the sole reason of wildfire risk reduction. Other site specific resource objectives would normally be the basis for prescribing a fuels treatment on natural forest fuels. Prescribed broadcast burning poses risks that in many cases would out weigh potential risk reduction benefits. In summary, fuels management treatments including prescribed broadcast burning, pile burning, manual or mechanical fuels treatments, or fuels removal would be applied primarily on activity fuels created from timber management operations.

C. Hydrology

Instream flow requirements in Cow Creek for aquatic species are probably being met by Galesville reservoir. However, the growth of some aquatic species is probably impaired due to extremely high summer stream temperatures and low flow conditions (Meehan 1991). The percent of annual runoff from June through September is very low, in most cases below 1 percent. Existing water quality and sedimentation in the Cow Creek WAU are probably the biggest limiting factors to the aquatic environment, especially during the summer low flow period.

The South Fork of Middle Creek and upper Middle Creek stream temperatures should improve as the riparian vegetation recovers.

A number of drainages have road densities greater than 4 miles per square mile on BLM administered lands. Road decommissioning is an effective method for reducing drainage extension and peak flows caused by high road densities.

D. Fisheries

Six of the seven stream reaches rated as poor in the Aquatic Habitat Inventories were located in the Upper or Lower Middle Creek subwatersheds. Currently, there is no priority list for watershed restoration within the Cow Creek WAU. However, Middle Creek is designated a Tier 1 Key Watershed and approximately half of the Key Watershed is designated Late-Successional Reserve. These two designations make watershed improvements and restoration in the Middle Creek Tier 1 Key Watershed a priority for the fisheries and aquatic resources. Restoration goals would be to improve the aquatic habitat and protect the resources dependent upon the habitat.

The following criteria were used to evaluate the subwatersheds from the fisheries resource perspective to determine the ratings used in Table 23.

Aquatic habitat condition - rating was based on best or potential future best aquatic habitat for cutthroat trout and coho salmon. This rating relied heavily on professional judgement, current aquatic habitat data, and partly on personal observations by biologists in the resource area.

Species diversity - Subwatersheds containing cutthroat, coho, steelhead, and chinook were rated the highest. Subwatersheds with a high degree of diversity (larger number of fish species) received a "4".

Access for anadromous fish - Subwatersheds containing natural blockages (i.e. waterfalls) were rated low (i.e. a "1" or "2"), because these watersheds were never refugia for anadromous fish stocks.

Ownership pattern was considered to a lesser degree. This takes into account how much influence BLM actions would have on cumulative impacts within the WAU and if the BLM administers a significant enough land base to improve current aquatic conditions.

E. Wildlife

1. Northern Spotted Owl

Based on the Standards and Guidelines in the SEIS ROD, activity centers on Matrix lands located before January 1 1994, must be protected by maintaining the best 100 acres of suitable habitat near known owl sites (USDA and USDI 1994b). Twelve spotted owl sites on BLM administered lands within the Cow Creek WAU are protected with 100 acre activity centers (core areas). An additional 19 spotted owl sites occur within the LSR portion of the WAU.

Land Use Allocations in the Cow Creek WAU consist of Matrix, Riparian Reserves, and LSR. The Roseburg BLM District ROD/RMP (USDI 1995) identified Matrix lands for timber management while providing for forest connectivity, various habitat types, a variety of forest successional stages, and ecological functions like dispersal of organisms. Managing the timing and spacing of harvest activities in Matrix is important to minimize impacts to spotted owls and other species associated with late-successional habitat.

Late-Successional Reserves are to be managed for late-successional, old-growth forests and the species that use these forests. The amount of suitable habitat on private lands surrounding BLM administered lands in the LSR is low. Future actions by private land owners would most likely reduce the current amount of suitable habitat on private lands.

The spotted owl is an example of a species that requires habitat connectivity, dispersal areas, and nesting areas. To assist in the decision making process and to guide the selection of areas where projects such as timber harvests, roads, or recreation sites may be located, a ranking of the owl master sites using the provincial radius (1.3 miles) and the 0.7 mile radius surrounding each owl site is presented in Table 24.

Table 24. Spotted Owl Activity Center Ranking Data Within the Cow Creek WAU in the South River Resource Area (1996).

MSNO	Year Site was Located	Last Year of Known Active Pair (Pair Status + # Juveniles)	Last Year Occupied (Pair Status)	No. Of Years of Reproduction/Pair Status Since 1985	Suitable Habitat Acres in Provincial Radius (1.3 Miles)	Suitable Habitat Acres in 0.7 Mile Radius	Land Use Allocation	Occupancy Rank	Acres Rank	History Ranking
0299	1976	U	ND	0/0	1,113	500	MATRIX	3	A	3
0299A	1985	1996(P+2J)	1996(P)	3/8	1,132	613	MATRIX	1	A	1
0300	1993	1993	1993(P)	0/1	806	260	MATRIX	2	D	3
0301	1989	1996(P+1J)	1996(P)	2/5	1,052	355	LSR	1	D	1
0302	1976	1985(P+0J)	1985(P)	0/1	531	291	MATRIX	3	D	3
0302A	1986	1986(P+2J)	1987(P)	1/2	543	235	MATRIX	3	D	3
0302B	1988	1988(P+0J)	1988(P)	0/1	666	240	MATRIX	3	D	3
0303	1977	1986(P+2J)	1986(P)	1/1	901	438	MATRIX	3	D	1
0303A	1987	1989(P)	1989(P)	2/3	605	310	MATRIX	3	D	1
0303B	1990	1996(M+F)	1996(M+F)	3/5	943	437	MATRIX	1	D	1
0303C	1991	1991(P+2J)	1991(P)	1/1	1,061	384	MATRIX	2	B	1
0308	1983	1996(P+2J)	1996(P)	3/6	1,121	585	LSR	1	A	1
0303A	1992	1994(P+2J)	1994(P)	2/3	1,135	560	LSR	2	A	1
0308B	1995	1995(P+0J)	1995(P)	0/1	1,136	586	LSR	2	A	1
0367	1987	1989(P+0J)	1995(S)	0/3	774	429	LSR	2	D	3
0369	1994	ND	ND	ND	566	199	LSR	3	D	3
0371	1976	ND	ND	ND	878	202	MATRIX	3	D	3
0372	1976	ND	ND	ND	1,102	201	LSR	3	B	3
0373	1978	1993(P+2J)	1993(P)	1/1	969	470	LSR	2	D	1
0373A	1984	1988(P+0J)	1988(P)	0/4	1,031	352	LSR	3	B	1
0373B	1989	1995(P+0J)	1995(P)	3/6	910	413	LSR	1	D	1
0374	1977	ND	ND	ND	681	273	LSR	3	D	3
0375	1985	1992(P+OJ)	1996(M)	1/5	1,085	486	LSR	2	B	2
0376	1986	1986(P+2J)	1996(M)	2/2	442	76	LSR	2	D	3
0377	1987	ND	ND	ND	445	217	LSR	3	D	3 PV

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0393	1987	1996(P+0J	1996(P)	1/3	933	442	LSR	2	D	2
0393A	1991	NP	1992(M)	ND	682	285	LSR	3	D	2
1808	1986	1988(P+0J)	1988(P)	1/3	778	363	LSR	3	D	2
1808A	1989	1993(P+0J)	1993(P)	1/4	901	372	LSR	2	D	2
1808B	1994	1994(P+2J)	1994(P)	1/1	1,048	338	LSR	2	B	1
1910	1987	1988(P+1J)	1993(M)	1/2	928	144	MATRIX	3	D	3 PV
1911	1987	1989(P+1J)	1989(P)	1/2	349	191	LSR	3	B	3 PV
1911A	1990	1996(P+2J)	1996(P)	2/4	1,295	288	LSR	3	B	2 PV
1911B	1991	1992(P+2J)	1992(P)	1/2	899	330	LSR	2	D	2
1912	1987	1995(P+0J)	1996(M+F)	2/5	954	381	LSR	2	D	2
1912A	1992	1992(P+2J)	1992(P)	1/1	844	329	LSR	2	D	2
1913	1987	1993(P+2J)	1993(P)	4/4	775	233	LSR	3	D	1 PV
1913A	1989	1990(P+0J)	1990(P)	0/1	719	284	LSR	2	D	1 PV
1913B	1992	1994(P+2J)	1994(P)	2/2	757	287	LSR	2	D	1
2000	1988	1995(P+0J)	1996(M+F)	2/3	963	547	MATRIX	2	C	1
2000A	1990	1991(P+2J)	1991(P)	2/2	886	406	MATRIX	2	D	1
2043	1989	1996(P+2J)	1996(P)	3/6	1,279	443	LSR	1	B	1
2043A	1992	1995(P+0J)	1995(P)	2/3	1,312	487	LSR	2	B	1
2044	1989	1990(P+2J)	1994(M+F)	1/2	1,387	424	LSR	2	B	3 PV
2045	1989	1989(P+0J)	1990(P)	0/1	1,113	367	MATRIX	3	B	3
2046	1989	1989(U)	1989(M+F)	0/0	1,136	391	LSR	2	B	3
2094	1989	1996(P+2J)	1996(P)	1/4	929	87	LSR	3	D	2 PV
2094A	1991	1991(P+1J)	1991(P)	1/1	927	130	LSR	3	D	1 PV
2096	1989	1995(P+0J)	1995(P)	2/5	884	284	LSR	2	D	2
2101	1989	NP	1993(M)	0/0	814	307	LSR	3	D	3

Table 24. Spotted Owl Activity Center Ranking Data Within the Cow Creek WAU in the South River Resource Area (1996).

MSNO	Year Site was Located	Last Year of Known Active Pair (Pair Status + # Juveniles)	Last Year Occupied (Pair Status)	No. Of Years of Reproduction/Pair Status Since 1985	Suitable Habitat Acres in Provincial Radius (1.3 Miles)	Suitable Habitat Acres in 0.7 Mile Radius	Land Use Allocation	Occupancy Rank	Acres Rank	History Ranking
2101A	1991	1994(P+0J)	1994(P)	1/2	821	414	LSR	2	D	2
2149	1989	NP	1996(M+F)	0/0	558	210	LSR	2	D	3
2205	1990	1995(P+0J)	1995(P)	3/6	656	177	MATRIX	1	B	1 OR
2209	1990	1996(P+0J)	1996(P)	3/7	1,031	268	LSR	1	B	1 PV
2538	1976	ND	ND	ND	790	306	LSR	3	D	3
2538A	1991	1996(P+2J)	1996(P)	2/5	750	265	LSR	1	D	1
3903	1994	1994(P+1J)	1994(P)	1/1	484	46	MATRIX	2	D	2
4016	1993	1996(P+2J)	1996(P)	1/3	172	26	MATRIX	1	D	1 PV
4047	1992	1996(P+0J)	1996(P)	0/2	669	367	LSR	2	D	1
4049	1992	1994(P+1J)	1995(M)	1/1	737	145	LSR	2	D	1 PV
4053	1994	1995(P+0J)	1996(M)	0/2	952	279	LSR	2	D	2
4054	1994	1996(P+0J)	1996(P)	0/2	1,057	371	MATRIX	2	B	2
4370	1995	1996(P+0J)	1996(P)	1/2	674	120	LSR	1	D	1 PV

Definitions

OCCUPANCY RANK- 1: Sites with this ranking have current occupancy and have been occupied by a single owl or pair of owls for the last 3 years; 2: Sites with this ranking have been occupied in the past, show sporadic occupancy by single owl or an owl pair, or may be currently occupied; 3: Sites with this ranking have not been occupied during the last 3 years.

LAST YEAR OF KNOWN ACTIVE PAIR - Gives the year, pair status, and number of young produced; NP = site has not had a pair; ND = No Data.

ACRES RANK - These acres are in regards to suitable spotted owl habitat. A: These sites have greater than 1,000 acres in the provincial radius and greater than 500 acres within the 0.7 mile radius; B: These sites have greater than 1,000 acres in the provincial radius but less than 500 acres within the 0.7 mile radius; C: These sites have less than 1,000 acres in the provincial radius and greater than 500 acres in the 0.7 mile radius; D: These sites have less than 1,000 acres in the provincial radius and less than 500 acres in the 0.7 mile radius.

HISTORY RANKING - This ranking includes occupancy ranking, reproduction data, acres ranking, habitat evaluation, field experience about the site (location, quality, and forest structure). 1: A site considered stable due to consistant occupation by spotted owls and has been producing young consistently; 2: Site is consistently used by spotted owls but reproduction has been sporadic; 3: Site shows no reproduction, occupation has been sporadic, or no occupation. OR = Site is on State of Oregon Lands. PV = Site is on private land.

PAIR STATUS - M = MALE; F = FEMALE; J = JUVENILE; P = PAIR STATUS; (M+F) = TWO ADULT BIRDS, PAIR STATUS UNKNOWN; PU = PAIR STATUS UNDETERMINED; ND = INCOMPLETE OR NO DATA.

NUMBER OF YEARS OF REPRODUCTION/PAIR STATUS SINCE 1985 - The first number gives the number of years with spotted owl reproduction at this site since 1985. The second number gives the number of years for the entire history of the activity center since 1985 (including the original and alternate sites, i.e. 1090A). ND = No Data.

The ranking is to provide management with a guide and does not represent a clearance as needed or a may affect determination as required by section 7 of the Endangered Species Act (ESA) of 1973, as amended.

All of the spotted owl territories on BLM administered lands within the Cow Creek WAU have less than 40% (1336 acres) of suitable habitat within 1.3 miles of the activity center. Mean values of suitable spotted owl habitat within 1.3 miles and 0.7 mile of activity centers in the LSR are 892 and 330 acres, respectively. Activity centers in Matrix have mean values of suitable spotted owl habitat within 1.3 miles and 0.7 mile of 878 and 367 acres, respectively. The amount of suitable habitat within 0.7 mile of activity centers is below 500 acres at all but two owl sites occupied in 1996 in the Cow Creek WAU (see Table 25).

Table 25. Amount of Suitable Spotted Owl Habitat Within 0.7 mile and 1.3 miles of Master Sites and Number of Sites in each Habitat Category in the Cow Creek WAU.

Owl Site Designation	**Greater than 500 Acres of Suitable Habitat Within 0.7 Mile and Greater than 1,000 Acres Within 1.3 Miles**		**Less than 500 Acres of Suitable Habitat Within 0.7 Mile and Less than 1,000 Acres Within 1.3 Miles**				**Less than 500 Acres of Suitable Habitat Within 0.7 Mile and Greater than 1,000 Acres Within 1.3 Miles**		
	BLM	Total	BLM	PV[1]	OR	Total	BLM	PV[1]	Total
Master Sites[2] and Alternate Sites in Matrix	2	2	11	3		14	3		3
Master Sites and Alternate Sites in LSR	3	3	22	8		30	8	3	11
Sites in Matrix Active in 1996	1	1	2	1		3	1		1
Sites in LSR Active in 1996	1	1	7	2		9	3	2	5
Potential Sites in Matrix	1	1	8	1	1	10	2		2
Potential Sites in LSR	1	1	13	6		19	7	2	9

1. BLM = Bureau of Land Management, PV = Private ownership near or next to BLM, OR = State of Oregon Land.
2. Master site refers to the first number given to a spotted owl activity center. Other activity centers identified in the vicinity of the original site are called alternate sites.

a. Dispersal Habitat

Information about dispersal habitat is also presented as a guide. Some quarter townships in the Cow Creek WAU are currently below the 50% threshold for dispersal habitat. The data in Table 19 shows that five

quarter townships are below the 50% threshold level (four of these are below 40%), one quarter township is at the 51-59% level, eight quarter townships are in the 60-69% level, and three quarter townships are above the 70% level. See Map 27 for the distribution of quarter townships across the watershed. The goal is to maintain dispersal habitat at or above 50% and physically connected to other forest areas.

b. Critical Habitat

Two critical habitat units (CHU-OR-62 and CHU-OR-63) lie within the Cow Creek WAU. Generally, the two critical habitat units are about two miles from each other. This distance is made up of alternating sections of private and public lands. About nine sections within CHU-OR-63 are designated as Connectivity Blocks. All sections in CHU-OR-62 are designated as Late-Successional Reserve. Riparian Reserves make up about 50% of the BLM administered land that lies between these two CHUs. The Riparian Reserves connect at section corners but lack connection to other BLM administered land.

Critical habitat objectives are to provide suitable habitat for a recovering population. The checkerboard ownership in both Critical Habitat Units (CHU-OR-62 and CHU-OR-63) will maintain a fragmented pattern in the future. Managing for well connected habitat in CHU-OR-63 would aid in keeping this Critical Habitat Unit functioning.

2. The Peregrine Falcon

An evaluation and surveys of potential peregrine falcon habitat in the Cow Creek WAU is ongoing. Development of recreation opportunities near potential peregrine habitat may conflict with Endangered Species Act objectives for this species.

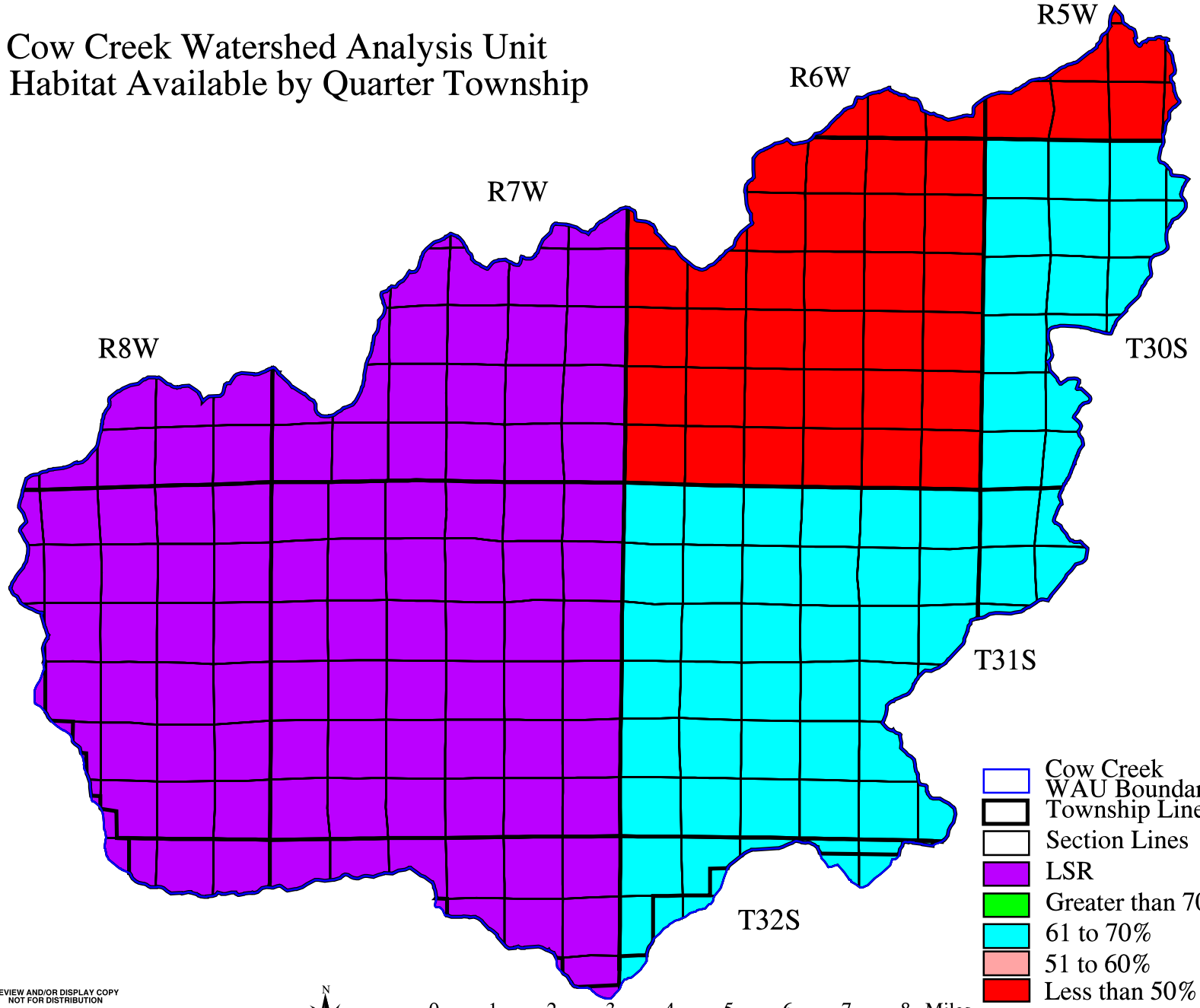
3. Marbled Murrelet

The majority (98.8%) of the marbled murrelet habitat in the Cow Creek WAU is inside the LSR. One Hundred and Thirty-five acres of murrelet habitat within the WAU are located outside of the LSR. Seventy-six of the 135 acres are located outside the 50 mile zone and do not require two year protocol surveys for marbled murrelets prior to implementation of projects that modify habitat. General surveys for murrelets in the Cow Creek WAU have not been conducted.

4. Amphibians

Protocol (IB-OR-96-161) guides for the Del Norte salamander state that projects should be evaluated to determine if clearance is required prior to ground disturbing activities. Generally, if suitable habitat is present in the project area and the project area is within 25 miles of a known site, then surveys and appropriate protection measures are required prior to project implementation. The entire Cow Creek WAU falls within 25 miles of known sites in the Medford District.

Map 27. Cow Creek Watershed Analysis Unit
50-11-40 Habitat Available by Quarter Township



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5. Elk

Goals for the Elk Management Areas have not been developed. Some potential management activities designed to improve elk habitat conditions may support LSR objectives and others may conflict. Managing for optimal cover (basically late-successional/old-growth stands) and thermal cover are essentially identical to LSR goals and objectives. Closing roads to reduce harassment to elk may also benefit LSR goals by reducing disturbance to late-successional/old-growth species, minimizing loss of habitat due to illegal firewood cutting and reducing the chance of accidental fire ignition. Some activities, such as creating or maintaining early seral stands for forage may conflict with LSR objectives, depending on the extent of the treatment. Treatments to create or maintain early seral stands within the LSR may not be necessary since private lands would probably continue to provide elk foraging habitat.

VI. Recommendations

A. Vegetation

Silvicultural treatments to protect and maintain Port-Orford Cedar in the WAU including road sanitation, which is removing Port-Orford Cedar near roads, and commercial thinning should be considered. Two areas to consider are T31S, R7W, Section 1 and T30S, R8W, Section 25.

Section 19 of T30S, R6W should be managed to avoid introduction of Phytophthora lateralis. Considering studying whether to include Section 19 in the Research Natural Area (RNA) and road closures may be ways of protecting Port-Orford Cedar from being infected by Phytophthora lateralis and protecting the Port-Orford Cedar in the Beatty Creek RNA from being infected.

Individual Port-Orford Cedars determined to be genetically resistant to Phytophthora lateralis by lab tests should be protected and retained.

Salvaging within the LSR should be considered if it is essential to reduce the risk of future stand replacing fires or insect damage.

Silvicultural treatments to restore large conifers in Riparian Reserves should be considered, especially within the Upper and Lower Middle Creek subwatersheds. Treatments may include precommercial or commercial thinning densely-stocked young stands to encourage development of large conifers, releasing young conifers from overtopping hardwoods, and reforesting shrub and hardwood-dominated stands with conifers. Silvicultural activities in Riparian Reserves should be designed to accelerate stand development to meet Aquatic Conservation Strategy objectives.

B. Fire and Fuels Management

Fire management in the Cow Creek WAU should consider aggressively suppressing all wildfires. Because of the checkerboard ownership pattern, very high resource values, air quality concerns, and extremely narrow windows of opportunity, natural ignition prescribed fires are not considered feasible. Risks to life, property, and resources are considered to be too high.

Prescribed fire, both broadcast burning and pile burning, should continue to be used to prepare regeneration harvest units for reforestation where other resource objectives can be achieved. Burning activity fuels achieves a secondary benefit of wildfire hazard reduction. When other resource concerns eliminate using prescribed fire, mechanical or manual fuels treatments may be used to achieve reforestation objectives.

C. Soils

One of the soils related concerns was granitic soils. Past management practices have shown that these soils are fragile and not very resilient. Management activities on granitic soils should proceed with caution. On-site investigation by a soil scientist is recommended for any ground disturbing activity on granitic soils.

Serpentine soils are another soils related concern that needs to be addressed. Existing native forest vegetation is best suited for these serpentinitic sites. Stand conversion to other commercial forest types is risky at best and should only be attempted if hard data exists to justify a forest type change.

Best Management Practices (BMPs) should be applied during all ground and vegetation disturbing activities. See Appendix D, Roseburg District Record of Decision and Resource Management Plan (USDI 1995) for a list and explanation of BMPs. Along with the BMPs, the Standards and Guidelines in the SEIS Record of Decision (USDA and USDI 1994b) should be implemented in order to achieve proper soil management. Best Management Practices should be monitored for implementation and effectiveness in order to document if soil goals are being achieved.

D. Hydrology

Water quality parameters should continue to be monitored in the Lower and Upper Middle Creek subwatersheds, especially at the Silver Butte mining site to assess recovery. Water quality restoration should continue in Middle Creek.

Riparian areas along fish bearing streams dominated by alders should be considered for conversion to conifers in order to provide a future source of large woody debris. Girdling the alders and underplanting conifers would not negatively impact current streamside shade or the sediment regime.

Density management should be considered in the Lower and Upper Middle Creek subwatersheds to improve and enhance riparian characteristics, by accelerating tree growth for future streamside shade. Placing large woody debris in Middle Creek should be considered to create habitat diversity and reduce localized erosion.

Determine which culverts have the potential for plugging, which culverts are undersized or poorly located and causing excessive erosion, and which road segments are functioning as an extension of the stream network.

In areas naturally prone to debris flows, consider designing road and stream crossings to allow large woody debris to be transported downstream past the road crossing. Generally, these crossings function as points that trap large woody debris. Road restoration or new construction activities in the middle to upper 1/3 of a drainage and in Rosgen A or Aa+ type stream channels are areas to consider including stream crossings that allow large woody debris to be transported downstream, instead of being trapped behind culverts.

Road decommissioning should be considered in six drainages. They are Buck Martin, Iron Mountain, Upper Union, Dutchman Creek, Panther Peavine, and Upper Middle Creek drainages. Specific roads would be identified in the Transportation Management Objectives (TMO).

Monitor suspended sediment, turbidity, and streamflow near mouth of Iron Mountain Creek.

Proper functioning condition (PFC) assessments should be continued.

Measure summer base flows at stream temperature monitoring sites. This will tell us streams that store more groundwater and subsequently release it as surface flow during the dry season. Iron Mountain, Union, Middle, and Cattle creeks are currently being monitored for stream temperature.

E. Fisheries

The priority for fisheries restoration in this WAU would be removing man-made barriers to fish passage (i.e. culverts) and replace them with structures that provide fish passage (i.e. bridges or bottomless arch pipes).

Monitor and maintain the culvert restoration work completed in the summer of 1995 on Iron Mountain, Cattle, and Council Creeks in the Cow Creek WAU.

Upper Middle Creek and Lower Middle Creek subwatersheds would benefit from stream and riparian restoration. Site specific surveys should be conducted to adequately address the need for any instream, riparian, or upslope (i.e. road improvement, decommissioning, slope stabilization) restoration projects. Areas to consider first for restoration activities include Martin Creek, Peavine Creek, Iron Mountain Creek, Union Creek, and Upper Middle Creek.

The two existing instream project sites on Martin Creek should be monitored and maintained.

Coho spawning surveys in the mainstem of Middle Creek and Martin Creek should continue. Additional spawning survey reaches in tributaries of Middle Creek should be selected. Areas to consider include the tributary to Martin Creek located in $SW^1/_4$, $SE^1/_4$, of section 1, in T32S, R7W, Buck Creek, Smith Creek, and Hare Creek.

Reclamation and restoration work should continue in the mainstem of Middle Creek to mitigate the adverse impacts of acid drainage from the Silver Butte mine. The project area should be monitored following winter streamflows. Instream project work in Middle Creek should be maintained.

Fish use of Middle Creek, upstream from the confluence with the South Fork of Middle Creek should be monitored.

F. Wildlife

1. The Northern Spotted Owl

The spotted owl sites were ranked to provide management with a guide for planning and conducting activities around owl sites. This ranking does not represent a clearance as needed, or may effect determination as required by section 7 of the Endangered Species Act (ESA) of 1973, as amended. The steps used to rank the owl sites are presented in Appendix E.

When planning projects that manipulate suitable spotted owl habitat, project areas should be selected considering the evaluation and ranking of owl sites in the Cow Creek WAU presented in Table 24. Table 24 provides information about the status of use, habitat acres, occupation, and reproduction success of owls in the Cow Creek WAU. The goal was to evaluate the habitat, connectivity and fragmentation of the habitat, and owl site history to create a priority list. This list can be used to locate project areas while taking into account the location of active spotted owl sites. The rankings in Table 24 were used to develop owl site rankings where projects should be planned.

The results of the owl site rankings for the Cow Creek WAU are listed in Table 26. Activities in the Matrix that modify or remove suitable owl habitat should be considered first in areas outside of known spotted owl territories. When it is not possible to avoid modifying or removing suitable habitat within an owl territory, then sites with "go to" rank of "one" should be first, "two" should be second, and "three" should be last.

For owl sites in the LSR, the rankings are where habitat evaluation should be considered first, before manipulating stands to improve habitat. Sites in the LSR with a rank of "1" should be considered first for habitat evaluation, "two" should be second, and "three" should be last. Habitat evaluation would determine which LSR objectives (increasing late seral age forests, increasing physical connectivity of late successional forests, reducing fragmentation, or connectivity of habitat) apply to a particular area.

Management actions to consider should be to maintain dispersal habitat at or above 50 percent in each quarter township and physically connected to other forest areas. Consider avoiding reducing dispersal habitat in quarter townships currently below 40 percent.

The checkerboard ownership in Critical Habitat Units OR-62 and OR-63 would be expected to maintain a fragmented pattern of late-successional/old-growth. Matrix lands that overlap Critical Habitat Unit (CHU-OR-63) should be managed so fragmentation does not reduce or eliminate the function of critical habitat.

2. The American Bald Eagle

Potential bald eagle habitat is present along Cow Creek. Forest stands within one mile and facing Cow Creek should be managed to provide habitat characteristics used by bald eagles. Management objectives for the LSR would maintain current habitat and allow other forest stands to attain characteristics important for bald eagle habitat. Management on Matrix lands having a direct line of sight to Cow Creek and the South Umpqua River should consider retaining bald eagle habitat characteristics, such as dominant old-growth trees.

Bald eagle winter surveys should be conducted along Cow Creek. The Cow Creek corridor is a potential wintering area. Use of the area for nesting is not likely, based on the absence of bald eagle observations during several years of osprey surveys in this WAU.

Table 26. Go to Ranking Table for Spotted Owl Master Sites in the Cow Creek WAU.

MATRIX LANDS		LSR	
MSNO[1]	Go To Rank For Timber Harvesting	MSNO[1]	Go To Rank For Habitat Evaluation
0300	1	0301	3
0371	1	0308	3
1910	1	0367	2
2045	1	0369	1
3903	1	0372	1
4054	1	0373	3
0302	2	0374	1
2000	2	0375	1
0299A	3	0376	1
0303B	3	0377	1
2205(OR)	3	0393	3
4016(PV)	3	1808	3
		1911	3
		1912	1
		1913	3
		2043	1
		2044	1
		2046	1
		2094	3

1. Complex includes original ID number (i.e. 0300) and alternate sites (i.e. 0300A) unless identified as unique. MSNO = Master Site Number. OR = Site is located on State of Oregon land. PV = Site is located on private land.

3. The Peregrine Falcon

Management guides include locating a no activity buffer around an active peregrine falcon site, seasonal restrictions during the peregrine falcon breeding season from March 1 to July 15, or maintaining the integrity of medium to high potential sites (USDI 1995). The buffer should include a no activity area of ½ to 1½ mile radius around known occupied sites. A secondary zone (½ to 1½ mile radius reflecting the shape of

primary zone) should be established where no management activities, such as timber harvesting, road construction, or helicopters are allowed during the peregrine falcon breeding season. Activities may resume in the secondary zone 14 days after fledgling or nest failure is confirmed. To maintain the integrity of a medium to high potential peregrine falcon nesting site, it should be managed as if it was occupied by including a no activity buffer and seasonal restrictions (March 1 to July 15). Projects that require a disturbance, such as blasting, near any medium to high potential habitat, located in the future, should be surveyed before project initiation. Blasting should be restricted if it occurs within three miles of an active site.

4. Marbled Murrelet

Terms and conditions from the USFWS should be followed to mitigate disturbance to potential marbled murrelet sites when project areas (LSR or Matrix) are located within 1/4 mile of unsurveyed suitable murrelet habitat. Consider implementing a project to evaluate and survey the identified suitable murrelet habitat in the Cow Creek WAU.

5. Neotropical Birds

Impacts to neotropical birds come from all actions that modify habitat. This usually changes the bird species composition using a particular area. Brushing, precommercial, and commercial activities impact neotropical birds by removing habitat and physically displacing birds. Displacement includes removing occupied habitat during the breeding season.

Ways to benefit neotropical birds would be to reduce impacts from of broadcast burning, brushing, regeneration harvest, precommercial thinning (PCT), commercial thinning, regeneration harvests, and other activities that manipulate habitat. Scheduling management activities to avoid disturbing birds during nesting and breeding periods should be considered. Local populations of neotropical birds start breeding in April and May and continue through the end of August. However, most species have young capable of flight by the beginning of July or August. Consider implementing projects impacting nesting habitat before April 1 or after July 30 of any given year.

Another way to reduce impacts is to consider the goals of Riparian Reserves when brushing, precommercial thinning, or broadcast burning areas. Brushing and PCT contracts should consider including different prescriptions for Riparian Reserves. This may include not brushing or thinning within the Riparian Reserves or increasing the number of shrub and non-commercial tree species retained. Matrix lands outside of Riparian Reserves also provide brush and non-commercial tree species used by neotropical birds. Prescriptions in these areas should retain brush and tree species that are not competing directly with the desired conifer species. Some brushing and PCT projects following these recommendations have been accomplished. The results should be reviewed and evaluated.

6. Other Species of Concern

a. Goshawk

Incidental or systematic surveys should be conducted to determine if and where goshawks are present in the WAU. Information about other raptor species that use the habitat in the WAU should continue to be gathered.

b. Amphibians

The Del Norte salamander survey data should be reviewed to evaluate the range in the Cow Creek WAU. All ground disturbing projects should be evaluated using protocol guides.

c. Mollusks

Surveys for Survey and Manage mollusk species should be conducted according to established protocol guides before any ground disturbing activities are conducted, this should also include commercial thinning and herbicide use. Surveys should be conducted according to the following priorities 1) clearance surveys of Fiscal Year (FY) 1999 and later projects, 2) survey LSRs and Riparian Reserves to document species occurrence in these areas, and 3) survey managed habitats and adjacent Riparian Reserves to evaluate impacts of timber harvesting and other habitat disturbances on specific mollusk sites. In general, more surveys are needed in the Cow Creek WAU to determine mollusk ranges, species abundance, and species diversity.

7. Big game species (Elk and Deer)

The opportunity exists to develop an elk management goal for the elk management areas that overlapping the Cow Creek Watershed Analysis Unit. The main question that needs to be answered is what level of elk management is envisioned by the Roseburg District and the Resource Area? A potential conflict is the goal of habitat manipulation for elk and spotted owl habitat, especially in the LSR portion of the WAU.

Possible options for managing the elk management areas are to manage for elk numbers through careful habitat management or manage for habitat only and let the elk numbers be what they will be (any habitat benefit would be achieved as a byproduct of mature forest conversion to younger age classes). Some benefits to elk could be obtained by preventing early age class stands (20 years old and younger) less than 40 acres in size from developing into older age classes, limiting harvest units to 40 acres or less to accommodate use by elk and deer, reducing road construction, closing roads, or using harvest methods that do not require roads in order to influence habitat use by elk. Management for elk should decrease the miles of road per acre, increase cover, and increase or maintain forage areas. Management of road use by people would help elk, deer, and other wildlife. Decommissioning or closing unwanted or unneeded roads and reducing new road construction would increase elk use of undisturbed areas.

Any approach to elk management would benefit from information about distribution and use of the Cow Creek WAU by elk. This information is not currently available.

VII. Monitoring

General objectives of monitoring are:
1) To determine if the plan is being implemented correctly.
2) Determine the effectiveness of management practices at multiple scales, ranging from individual sites to watersheds.
3) Validate whether ecosystem functions and processes have been maintained as predicted.

The Roseburg RMP, Appendix I provides monitoring guidelines for various land use allocations and resources discussed by the plan. Implementation, effectiveness, and validation monitoring questions are addressed. Management actions on the Roseburg District BLM may be monitored prior to project initiation and following project completion, depending on the resource or activity being monitored.

Some key resource elements to monitor in the Cow Creek WAU are as follows:

A. All land use allocations

Are surveys for the species listed in the Roseburg District RMP, Appendix H conducted before ground disturbing activities occur?
Are protection buffers being provided for specific rare and locally endemic species and other species in the upland forest matrix?
Are the sites of amphibians, mammals, bryophytes, mollusks, vascular plants, fungi, lichens, and arthropod species listed in Appendix H of the Roseburg District RMP being surveyed?
Are the sites of amphibians, mammals, bryophytes, mollusks, vascular plants, fungi, lichens, and arthropod species listed in Appendix H of the Roseburg District RMP being protected?
Are high priority sites for species management being identified?

B. Key Watersheds

Was watershed analysis completed prior to implementation of management activities?
Has the number of miles of roads been reduced or at least no net increase in roads been achieved?
Are at-risk fish species and stocks being identified?
Are fish habitat restoration and enhancement activities being designed and implemented which contribute to attainment of Aquatic Conservation Strategy objectives?
Are potential adverse impacts to fish habitat and fish stocks being identified?

C. Riparian Reserves

Is the width and integrity of the Riparian Reserves maintained?
Are management activities within Riparian Reserves consistent with SEIS ROD Standards and Guideline, RMP management direction, and Aquatic Conservation Strategy objectives?
Has Watershed Analysis been completed prior to on-the-ground actions being initiated in Riparian Reserves?

D. Matrix

Are suitable numbers of snags, coarse woody debris, and green trees being left following timber harvesting as called for in the SEIS ROD Standards and Guidelines and Roseburg RMP management direction?
Are timber sales being designed to meet ecosystem objectives for the Matrix?
Are forests growing at a rate that will produce the predicted yields?
Are forests in the Matrix providing for connectivity between Late-Successional Reserves?

E. Late-Successional Reserves

What activities were conducted or authorized within the LSR and how were they compatible with objectives of the LSR Assessment?
Were activities consistent with the SEIS ROD Standards and Guidelines, Roseburg RMP management direction, the LSR Assessment, and REO review requirements?
What is the status of development and implementation plans to eliminate or control non-native species which adversely impact late-successional objectives?
Are projects conducted in the LSR designed to maintain, improve, or attain LSR objectives?

VIII. Revisions to the Watershed Analysis and Data Gaps

Watershed analysis is an ongoing, iterative process designed to help define important resource information needed for making sound management decisions. This watershed analysis will be updated as existing information is refined, new data becomes available, new issues develop, when significant changes occur in the WAU, or as management needs dictate.

Roads in the Cow Creek WAU are being evaluated using the Transportation Management Objectives (TMOs) as a guide. This evaluation would compile a list of roads that may be considered for decommissioning or improving. The completed TMOs would be added to update the watershed analysis.

Other data gaps include the amount of terrestrial large woody debris occurring in late-successional/old-growth stands within the Cow Creek WAU and water quality and stream temperature information for tributaries of Cow Creek (other than Middle Creek).

Appendix A

Glossary

Appendix A

Glossary

Age Class - One of the intervals into which the age range of trees is divided for classification or use.

Anadromous Fish - Fish that are born and reared in freshwater, move to the ocean to grow and mature, and return to freshwater to reproduce. Salmon, steelhead, and shad are examples.

Aquatic Conservation Strategy - Plan developed in Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl, designed to maintain and restore ecosystem health at watershed and landscape scales to protect habitat for fish and other riparian-dependent species and resources and restore currently degraded habitats.

Beneficial Use - The reasonable use of water for a purpose consistent with the laws and best interest of the peoples of the state. Such uses include, but are not limited to, the following: instream, out of stream and groundwater uses, domestic, municipal, industrial water supply, mining, irrigation, livestock watering, fish and aquatic life, wildlife, fishing, water contact recreation, aesthetics and scenic attraction, hydropower, and commercial navigation.

Best Management Practices (BMPs) - Methods, measures, or practices designed to prevent or reduce water pollution. Not limited to structural and nonstructural controls, and procedures for operations and maintenance. Usually, Best Management Practices are applied as a system of practices rather than a single practice.

Bureau Assessment Species - Plant and animal species on List 2 of the Oregon Natural Heritage Data Base, or those species on the Oregon List of Sensitive Wildlife Species (OAR 635-100-040), which are identified in BLM Instruction Memo No. OR-91-57, and are not included as federal candidate, state listed or Bureau sensitive species.

Bureau Sensitive Species - Plant or animal species eligible for federal listed, federal candidate, state listed, or state candidate (plant) status, or on List 1 in the Oregon Natural Heritage Data Base, or approved for this category by the State Director.

Candidate Species - Those plants and animals included in Federal Register "Notices of Review" that are being considered by the United States Fish and Wildlife Service (FWS) for listing as threatened or endangered.

> Category 1. Taxa for which the Fish and Wildlife Service has substantial information on hand to support proposing the species for listing as threatened or endangered. Listing proposals are either being prepared or have been delayed by higher priority listing work.

Commercial Thinning - The removal of merchantable trees from an even-aged stand to encourage growth of the remaining trees.

Connectivity - A measure of the extent to which conditions between late-successional/old-growth forest areas provide habitat for breeding, feeding, dispersal, and movement of late-successional/old-growth-associated wildlife and fish species.

Connectivity/Diversity Block - A land use classification under Matrix lands managed on 150 year area control rotations. Periodic timber sales will leave 12 to 18 green trees per acre.

Core Area - That area of habitat essential in the breeding, nesting and rearing of young, up to the point of dispersal of the young.

Critical Habitat - Under the Endangered Species Act, (1) the specific areas within the geographic area occupied by a federally listed species on which are found physical and biological features essential to the conservation of the species, and that may require special management considerations or protection; and (2) specific areas outside the geographic area occupied by a listed species when it is determined that such areas are essential for the conservation of the species.

Density Management - Cutting of trees for the primary purpose of widening their spacing so that growth of remaining trees can be accelerated. Density management harvest can also be used to improve forest health, to open the forest canopy, or to accelerate the attainment of old growth characteristics if maintenance or restoration of biological diversity is the objective.

District Defined Reserves (DDR) - Areas designated for the protection of specific resources, flora and fauna, and other values. These areas are not included in other land use allocations nor in the calculation of the Probable Sale Quantity.

Endangered Species - Any species defined through the Endangered Species Act as being in danger of extinction throughout all or a significant portion of its range and published in the Federal Register.

Endemic - Native or confined to a certain locality.

Environmental Assessment (EA) - A systematic analysis of site-specific BLM activities used to determine whether such activities have a significant effect on the quality of the human environment and whether a formal environmental impact statement is required; and to aid an agency's compliance with National Environmental Protection Agency when no Environmental Impact Statement is necessary.

Ephemeral Stream - Streams that contain running water only sporadically, such as during and following storm events.

50-11-40 Rule - A proposed guideline requiring maintenance of adequate spotted owl dispersal habitat on lands outside designated "habitat conservation areas" for the Northern Spotted Owl. It would assure that, on the quarter township basis, 50 percent of the stands would have conifers averaging 11 inches dbh and a 40 percent canopy closure.

Fluvial - Migratory behavior of fish moving away from the natal stream to feed, grow, and mature then returning to the natal stream to spawn.

General Forest Management Area (GFMA) - Forest land managed on a regeneration harvest cycle of 70-110 years. A biological legacy of six to eight green trees per acre would be retained to assure forest health. Commercial thinning would be applied where practicable and where research indicates there would be gains in timber production.

GIS - Geographic Information System, a computer based mapping system used in planning and analysis.

Intermittent Stream - Any nonpermanent flowing drainage feature having a definable channel and evidence of scour or deposition. This includes what are sometimes referred to as ephemeral streams if they meet these two criteria.

Issue - A matter of controversy or dispute over resource management activities that is well defined or topically discrete. Addressed in the design of planning alternatives.

Land Use Allocations - Allocations which define allowable uses/activities, restricted uses/activities, and prohibited uses/activities. They may be expressed in terms of area such as acres or miles etc. Each allocation is associated with a specific management objective.

Late-Successional Forests - Forest seral stages which include mature and old-growth age classes.

Late-Successional Reserve (LSR) - A forest in its mature and/or old-growth stages that has been reserved.

Matrix Lands - Federal land outside of reserves and special management areas that will be available for timber harvest at varying levels.

Mitigating Measures - Modifications of actions which (a) avoid impacts by not taking a certain action or parts of an action; (b) minimize impacts by limiting the degree or magnitude of the action and its implementation; (c) rectify impacts by repairing, rehabilitating or restoring the affected environment; (d) reduce or eliminate impacts over time by preservation and maintenance operations during the life of the action; or (e) compensate for impacts by replacing or providing substitute resources or environments.

Monitoring - The process of collecting information to evaluate if objectives and anticipated or assumed results of a management plan are being realized or if implementation is proceeding as planned.

Nonpoint Source Pollution - Water pollution that does not result from a discharge at a specific, single location (such as a single pipe) but generally results from land runoff, precipitation, atmospheric deposition or percolation, and normally is associated with agricultural, silvicultural and urban runoff, runoff from construction activities, etc. Such pollution results in the human-made or human-induced alteration of the chemical, physical, biological, radiological integrity of water.

Orographic - Of or pertaining to the physical geography of mountains and mountain ranges.

Peak Flow - The highest amount of stream or river flow occurring in a year or from a single storm event.

Perennial Stream - A stream that has running water on a year round basis.

Phenotypic - Of or pertaining to the environmentally and genetically determined observable appearance of an organism.

Precommercial Thinning (PCT) - The practice of removing some of the trees less than merchantable size from a stand so that remaining trees will grow faster.

Probable Sale Quantity (PSQ) - Probable sale quantity estimates the allowable harvest levels for the various alternatives that could be maintained without decline over the long term if the schedule of harvests and regeneration were followed. "Allowable" was changed to "probable" to reflect uncertainty in the calculations for some alternatives. Probable sale quantity is otherwise comparable to allowable sale quantity (ASQ). However, probable sale quantity does not reflect a commitment to a specific cut level. Probable sale quantity includes only scheduled or regulated yields and does not include "other wood" or volume of cull and other products that are not normally part of allowable sale quantity calculations.

Proposed Threatened or Endangered Species - Plant or animal species proposed by the U.S. Fish & Wildlife Service or National Marine Fisheries Service to be biologically appropriate for listing as threatened or endangered, and published in the Federal Register. It is not a final designation.

Resident Fish - Fish that are born, reared, and reproduce in freshwater.

Resource Management Plan (RMP) - A land use plan prepared by the BLM under current regulations in accordance with the Federal Land Policy and Management Act.

Riparian Reserves - Designated riparian areas found outside Late-Successional Reserves.

Riparian Zone - Those terrestrial areas where the vegetation complex and microclimate conditions are products of the combined presence and influence of perennial and/or intermittent water, associated high water tables and soils which exhibit some wetness characteristics. Normally used to refer to the zone within which plants grow rooted in the water table of these rivers, streams, lakes, ponds, reservoirs, springs, marshes, seeps, bogs and wet meadows.

Stream Order - A hydrologic system of stream classification. Each small unbranched tributary is a first order stream. Two first order streams join to form a second order stream. A third order stream has only first and second order tributaries, and so on.

Stream Reach - An individual first order stream or a segment of another stream that has beginning and ending points at a stream confluence. Reach end points are normally designated where a tributary confluence changes the channel character or order. Although reaches identified by BLM are variable in length, they normally have a range of 1/2 to 1-1/2 miles in length unless channel character, confluence distribution, or management considerations require variance.

Survey and Manage - Those species that are listed in Table C-3 of the Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl for which four survey strategies are defined.

Tillage - Breaking up the compacted soil mass to promote the free movement of water and air using a self drafting individual tripping winged subsoiler.

Transportation Management Objectives (TMO) - An evaluation of the current BLM transportation system to assess future need for roads, and identify road problem areas which need attention, and address future maintenance needs.

Watershed - The drainage basin contributing water, organic matter, dissolved nutrients, and sediments to a stream or lake.

Watershed Analysis - A systematic procedure for characterizing watershed and ecological processes to meet specific management and social objectives. Watershed analysis is a stratum of ecosystem management planning applied to watersheds of approximately 20 to 200 square miles.

Appendix B

References

Appendix B - References

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Appendix C

Fisheries

Table C-1. ODFW Aquatic Habitat Inventory Data Table

Stream	Reach	% Pool Area	Residual Pool Depth	Riffle W/D Ratio	% Fines in Riffles	% Gravel in Riffles	Riparian Vegetation (dom/subdom)	Riparian Conifer Size	% Shade	LWD pieces per 100m	LWD vol per 100m	Aquatic Habitat Rating (AHR)
Ash (Mitchell) Cr	1	41.2	0.5	24.3	1	69	hdwd/con	small	79	0.1	0.3	Fair
	2	28.8	0.5	22.0	2	69	hdwd/con	small	97	0.6	0.5	Fair
	3	4.7	0.6	18.9	1	52	hdwd/con	small	89	1.7	6.8	Fair
	4	7.1	0.5	18.5	0	42	hdwd/con	medium	94	6.9	13.6	Fair
Beatty Cr	1	8.3	0.5	17.0	3	75	con/hdwd	medium	99	6.3	19.0	Fair
Buck (Cow Cr)	1	13.6	0.5	13.3	3	26	hdwd/con	medium	91	16.6	43.7	Fair
	2	33.2	0.5	15.7	3	45	con/hdwd	medium	79	5.6	5.8	Fair
Buck (Middle Cr)	1	24.8	0.3	20.6	8	30	con/hdwd	small	83	8.4	11.8	Fair
	2	20.8	0.3	18.8	8	24	con/hdwd	small	82	1.2	1.1	Fair
	3	1.9	0.8	25	0	100	con/hdwd	small	96	3.5	9.2	Fair
Catching Cr	1	18.3	0.4	21.8	1	52	hdwd/con	small	93	0.5	0.3	Fair
	2	32.2	0.4	26.7	1	53	hdwd/con	small	93	1.0	1.2	Fair
	3	16.0	0.3	28.3	2	37	con/hdwd	small	95	0.7	0.9	Fair
	4	30.0	0.4	19.4	3	23	con/hdwd	medium	99	2.1	8.0	Fair
Cattle Cr	1	14.7	0.4	21.8	1	47	hdwd/con	small	88	1.4	3.2	Fair
	2	15.8	0.5	16.8	0	33	hdwd/con	small	62	1.6	1.4	Fair
	3	13.7	0.7	17.9	1	39	hdwd/con	small	66	5.1	8.1	Fair
Cedar Gulch	1	21.8	0.2	10.9	5	16	hdwd/con	small	87	5.1	8.0	Fair
	2	40.0	0.3	6.1	68	10	con/hdwd	medium	61	5.1	7.3	Poor
Council Cr	1	23.0	0.3	15.4	0	50	hdwd/con	small	94	0.5	0.3	Fair
	2	--	--	--	--	--	--	--	--	--	--	--
	3	23.0	0.4	17.8	4	32	con/hdwd	small	95	3.2	10	Fair

Table C-1. ODFW Aquatic Habitat Inventory Data Table

Stream	Reach	% Pool Area	Residual Pool Depth	Riffle W/D Ratio	% Fines in Riffles	% Gravel in Riffles	Riparian Vegetation (dom/subdom)	Riparian Conifer Size	% Shade	LWD pieces per 100m	LWD vol per 100m	Aquatic Habitat Rating (AHR)
Darby Cr	1	22.4	0.6	13.1	0	58	hdwd/con	small	85	4.9	8.9	Fair
	2	15.8	0.5	15.0	0	55	hdwd/con	small	60	11.0	28.6	Fair
	3	14.9	0.6	14.0	0	59	con/hdwd	medium	90	19.0	50.8	Good
Doe Cr	1	12.8	0.5	16.7	3	42	hdwd/con	small	92	1.0	2.0	Fair
	2	26.1	0.5	20.9	1	58	con/hdwd	small	93	1.7	1.4	Fair
	3	17.4	0.4	15.9	1	63	con/hdwd	small	75	0.6	0.4	Fair
	4	15.4	0.4	14.0	1	57	con/hdwd	small	95	2.4	3.7	Fair
	5	8.5	0.4	10.0	0	52	con/hdwd	small	80	0.7	1.0	Fair
Iron Mtn Cr	1	20.9	0.5	16.2	0	29	hdwd/con	small	86	1.9	3.9	Fair
	2	24.3	0.6	15.0	3	56	hdwd/con	medium	91	2.4	6.2	Fair
	3	8.7	0.5	16.9	0	50	hdwd/con	medium	80	5.4	12.3	Fair
	4	12.1	0.6	11.3	0	62	con/hdwd	small	89	6.1	16.4	Fair
Little Dads Cr	1	20.6	0.6	23.8	5	59	con/hdwd	medium	97	7.4	32.6	Fair
	2	17.7	0.4	26.0	10	80	con/hdwd	medium	96	8.8	30.5	Fair
Live Oak Cr	1	48.9	0.6	16.5	17	63	con/hdwd	small	84	4.4	9.4	Fair
	2	77.1	0.5	33.5	35	28	con/hdwd	small	45	0.7	0.7	Poor
Martin Cr	1	6.0	0.4	27.0	9	30	con/hdwd	medium	90	3.0	8.5	Fair
	2	--	0.0	15.8	6	24	con/hdwd	medium	72	2.9	4.6	Poor
Middle Cr	1	22.7	0.8	21.5	9	24	hdwd/con	small	69	0.9	2.5	Fair
	2	12.3	0.7	23.0	5	20	con/hdwd	medium	67	1.5	4.1	Poor
	3	7.8	0.4	28.6	8	36	hdwd/con	small	88	1.7	2.7	Fair
	4	0.3	0.4	35.0	17	40	hdwd/con	small	75	3.5	12.7	Poor
Peavine Cr	1	14.8	0.4	22.2	5	15	con/hdwd	small	69	1.0	2.0	Poor

Table C-1. ODFW Aquatic Habitat Inventory Data Table

Stream	Reach	% Pool Area	Residual Pool Depth	Riffle W/D Ratio	% Fines in Riffles	% Gravel in Riffles	Riparian Vegetation (dom/subdom)	Riparian Conifer Size	% Shade	LWD pieces per 100m	LWD vol per 100m	Aquatic Habitat Rating (AHR)
	2	32.0	0.4	27.8	5	26	con/hdwd	small	70	2.5	2.1	Fair
	3	11.2	0.4	20.2	6	28	hdwd/con	small	98	2.6	9.7	Fair
Russel Cr	1	8.6	0.5	28.0	0	23	hdwd/con	small	82	1.5	1.2	Fair
	2	19.1	0.3	21.3	0	23	hdwd/con	small	99	3.4	7.6	Fair
Salt Cr	1	13.8	0.4	--	--	--	hdwd/con	small	96	9.6	32.2	--
	2	2.7	0.3	5.0	41	33	hdwd/con	medium	50	3.1	3.9	Fair
	3	1.0	0.2	--	--	--	hdwd/con	small	72	4.3	1.3	--
Shoestring Cr	1	0.9	0.4	--	--	--	hdwd/con	small	87	1.5	0.4	--
	2	--	0.0	--	--	--	con/hdwd	small	95	0.5	1.0	--
S. Fork Middle Cr	1	2.8	0.5	23.5	10	22	hdwd/con	small	74	1.5	2.6	Poor
	2	5.0	0.4	22.8	10	35	hdwd/con	small	90	2.6	4.7	Fair
	3	2.5	0.4	16.3	15	36	con/hdwd	small	97	2.5	3.5	Fair
	4	60.6	0.7	31.0	63	31	hdwd/con	small	82	5.7	15.5	Fair
	5	28.5	0.6	17.4	48	45	con/hdwd	small	70	4.2	10.6	Fair
Table Cr	1	31.7	0.5	22.0	0	20	con/hdwd	medium	92	2.1	7.4	Fair
	2	50.8	0.5	3.0	0	75	hdwd/con	medium	96	3.4	12.6	Good
	3	26.3	0.7	--	--	--	hdwd/con	medium	74	4.0	15.2	--
	4	38.4	0.5	16.0	10	70	con/hdwd	med/large	86	4.8	13.8	Fair
Union Cr	1	28.3	0.7	23.6	4	39	con/hdwd	small	74	3.8	14.7	Fair
	2	35.8	0.6	24.6	3	41	con/hdwd	small	82	4.6	14.5	Fair
	3	32.3	0.6	21.1	6	56	hdwd/con	small	85	6.8	23.2	Fair
	4	4.0	0.4	25.0	0	64	con/hdwd	small	96	4.0	10.2	Fair

-- = no data available

Table C-2. Summary Table of Current Conditions in the Cow Creek WAU.

Subwatershed Name Drainage Name	Road density	Stream drainage density	% BLM ownership	stream crossing density	Percent Less than 30 Years Old	HRP %	Percent of Riparian Reserves at least 80 Years Old
Lane-Judd	5.53	4.01	12				59
Jerry Creek	4.72	4.30	7	2.63	14	89	42
Judd Creek	3.99	6.07	34	1.18	13	90	61
Lane Creek	4.08	4.64	23	1.85	22	65	59
Nickle Mountain	8.97	3.82	8	5.32	0	100	100
Riddle	5.48	2.42	0.1	0.92	10	N/A	0
Tri City North	6.29	5.18	10	1.24	12	54	50
Tri City South	5.83	2.85	7	0.82	6	N/A	72
Weaver Road	6.92	3.41	9	2.58	17	74	57
Lower Cow Creek	4.71	6.79	37				63
Beatty Creek	2.60	5.72	30	2.11	3	99	97
Buck Creek	4.49	7.89	43	2.13	50	40	70
Doe Creek	6.62	8.08	25	3.10	62	48	34
Iron Mountain	4.41	5.84	51	1.26	52	43	71
Island Creek	4.72	5.88	41	2.07	39	59	45
Paten Creek	3.36	6.05	48	1.48	13	62	77
Salt Creek	5.21	7.13	28	1.92	37	56	66
Middle Cow Creek	4.45	7.75	47				62
Cattle Creek	6.08	8.97	48	3.36	53	58	59
Little Dads Creek	5.25	9.31	53	2.94	40	72	54
Table Creek	3.07	6.33	44	1.08	19	67	70
Upper Cow Creek	4.92	8.87	48				65
Darby Creek	4.22	8.96	51	2.38	43	99	79
Dutchman Creek	4.67	8.77	50	2.61	35	56	79
Lower Union	7.03	9.62	46	4.38	60	59	56
Tough Cow	5.21	10.72	58	3.44	29	71	78
Upper Union	4.14	7.30	39	2.51	30	70	26

Table C-2. Summary Table of Current Conditions in the Cow Creek WAU.

Subwatershed Name Drainage Name	Road density	Stream drainage density	% BLM ownership	stream crossing density	Percent Less than 30 Years Old	HRP %	Percent of Riparian Reserves at least 80 Years Old
Lower Middle Creek	5.95	9.05	45				53
Audie Creek	6.78	10.08	43	4.22	47	66	49
Buck Martin	6.39	8.17	56	3.01	73	35	29
Cedar Smith	5.86	8.42	44	2.73	47	55	68
Hare Creek	6.26	12.58	53	4.04	34	70	60
Lower Middle Creek	6.41	9.95	41	4.16	63	40	49
Martin Creek	4.62	6.38	36	2.81	31	76	65
Upper Middle Creek	6.15	8.94	37				56
Gravel Brush	6.78	11.08	39	3.17	59	58	44
Panther Peavine	5.92	7.56	51	3.46	52	63	63
South Fork Middle Creek	6.05	8.10	22	3.03	64	45	49
Upper Middle Creek	5.83	9.29	46	2.75	42	58	71
Russel Creek	5.52	5.90	41				60
Catching Creek	4.44	6.15	43	1.53	11	95	71
Council Creek	5.51	6.01	37	1.96	39	66	47
Mitchell Creek	5.62	5.16	44	2.53	10	92	61
Russel Creek	5.81	6.14	44	2.70	16	89	55
Shoestring	6.84	6.35	29	3.77	11	52	66

N/A = Not Applicable, since the Drainage does not contain any land within the Transient Snow Zone

Appendix D

Hydrology

Appendix D

Table D-1. Monthly and Annual Discharge Data for Cow Creek near Azalea from 1926 to 1985 (Drainage Area = 78 square miles).

Month	Number of Years of Records	Minimum Flow (cfs)	Year	Maximum Flow (cfs)	Year	Mean Flow (cfs)	Percent annual runoff
October	56	8.1	1937	294	1951	25	1.9
November	56	9.1	1937	542	1974	89	6.5
December	56	14	1937	765	1982	211	15.8
January	55	15	1937	926	1974	260	19.5
February	55	17	1977	685	1983	250	17.1
March	55	35	1934	521	1938	210	15.8
April	60	25	1926	328	1938	152	11.0
May	60	15	1931	268	1963	78	5.9
June	60	9.1	1926	129	1953	37	2.7
July	60	6.2	1926	35	1953	17	1.3
August	60	4.9	1931	22	1976	11	0.9
September	60	4.7	1929	30	1978	11	0.8
Annual		23	1977	269	1974	113	100

Appendix D

Table D-2. Monthly and Annual Discharge Data for the West Fork of Cow Creek near Glendale from 1956 to 1987 (Drainage Area = 87 square miles).

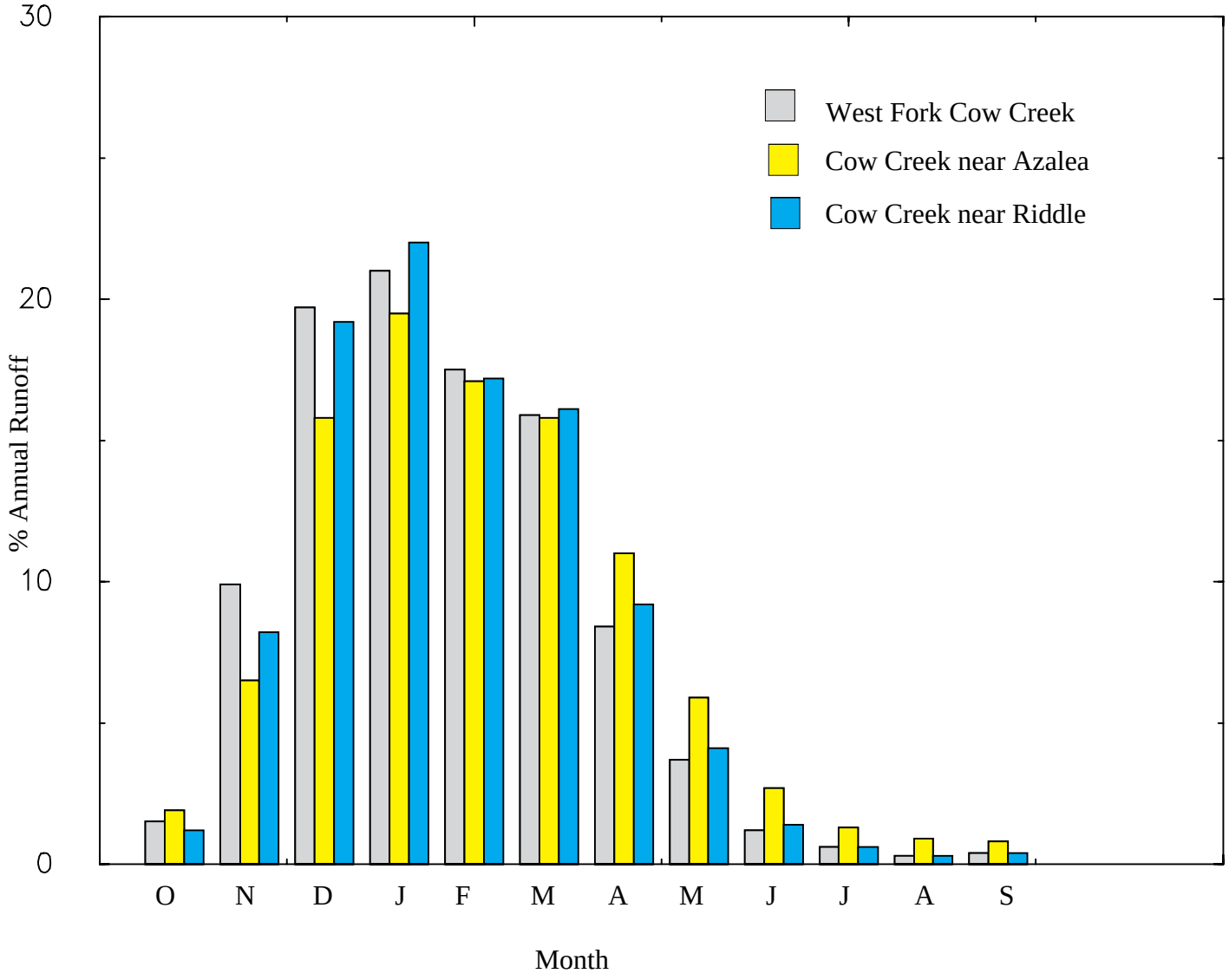
Month	Number of Years of Records	Minimum Flow (cfs)	Year	Maximum Flow (cfs)	Year	Mean Flow (cfs)	Percent annual runoff
October	32	8.5	1975	254	1963	48	1.5
November	32	14	1977	1,470	1974	329	9.9
December	32	13	1977	1,670	1956	635	19.7
January	32	24	1977	1,500	1970	675	21.0
February	32	66	1977	1,660	1958	616	17.5
March	32	116	1965	934	1983	510	15.9
April	32	78	1977	840	1982	280	8.4
May	32	38	1987	477	1963	118	3.7
June	32	19	1987	79	1960	38	1.2
July	32	10	1987	29	1983	18	0.6
August	32	6.0	1987	16	1983	10	0.3
September	32	5.0	1987	56	1986	14	0.4
Annual		60	1977	499	1974	273	100

Appendix D

Table D-3. Monthly and Annual Discharge Data for Cow Creek near Riddle from 1955 to 1985 (Drainage Area = 456 square miles).

Month	Number of Years of Records	Minimum Flow (cfs)	Year	Maximum Flow (cfs)	Year	Mean Flow (cfs)	Percent annual runoff
October	31	40	1975	633	1963	131	1.2
November	31	59	1977	4,710	1974	901	8.2
December	31	58	1977	6,570	1956	2,040	19.2
January	31	84	1977	5,890	1956	2,340	22.0
February	31	161	1977	5,900	1958	2,010	17.2
March	31	506	1965	3,400	1974	1,710	16.1
April	31	199	1977	2,720	1982	1,010	9.2
May	31	172	1973	1,940	1963	432	4.1
June	31	75	1973	264	1958	154	1.4
July	31	24	1977	135	1983	67	0.6
August	31	14	1977	79	1983	37	0.3
September	31	25	1974	156	1978	44	0.4
Annual		147	1977	1,810	1974	903	100

. Chart D-1. Percent Annual Runoff in the Cow Creek WAU



APPENDIX E

Wildlife

APPENDIX E

These steps were followed to reach the recommendations given in Table 26. It uses information gathered at the Resource Area level. Spotted owl site ranking and general suitable habitat evaluation are the two topics to consider when planning management activities affecting spotted owl suitable habitat.

A. Spotted Owl Site Ranking

1. Gathered information to create Table 24. Values given in Table 24 were from owl survey data and suitable habitat inventory data.
2. Table 24 contains information on historic and current owl sites. The owl sites best representing the territory locations were selected. Usually the number of potential sites is lower than the sum number of historical sites and current sites. The reason is that any one activity center can have more than one alternate location. Usually the area of these different alternate numbers overlap. Some have alternate numbers that are physically in a different drainage, subwatershed, ownership, or section.
3. Criteria steps **a** through **m,** listed below, were used to group the selected owl sites to determine the rankings.

Criteria list:

a) Areas where owl sites are **not** present should be considered first.

b) If sites cannot be avoided, then sites that have more than 1,000 acres of suitable habitat in the provincial radius and more than 500 acres in the 0.7 mile radius with occupancy and history rankings of "3" should be considered **second**.

c) Sites with less than 1,000 acres of suitable habitat in the provincial radius and less than 500 acres in the 0.7 mile radius with occupancy and history rankings of "3" should be considered **third**.

d) Sites with an occupancy ranking of "2" and a history ranking of "3" should be considered **fourth**.

e) Sites with an occupancy ranking of "3" and a history ranking of "2" should be considered **fifth**.

f) Sites with more than 1,000 acres of suitable habitat in the provincial radius and more than 500 acres in the 0.7 mile radius with occupancy and history rankings of "2" should be considered **sixth**.

g) Sites with less than 1,000 acres of suitable habitat in the provincial radius and less than 500 acres in the 0.7 mile radius with occupancy and history rankings of "2" should be considered **seventh**.

h) Sites with more than 1,000 acres of suitable habitat in the provincial radius and more than 500 acres in the 0.7 mile radius with an occupancy ranking of "1" and a history ranking of "2" should be considered **eighth**.

i) Sites with more than 1,000 acres of suitable habitat in the provincial radius and more than 500 acres in the 0.7 mile radius with an occupancy ranking of "2" and a history ranking of "1" should be considered **ninth**.

j) Sites with more than 1,000 acres of suitable habitat in the provincial radius and more than 500 acres in the 0.7 mile radius with an occupancy ranking of "1" and a history ranking of "2" should be considered **tenth**.

k) Sites with less than 1,000 acres of suitable habitat in the provincial radius and less than 500 acres in the 0.7 mile radius with an occupancy ranking of "1" and a history ranking of "2" should be considered **eleventh**.

l) Sites with less than 1,000 acres of suitable habitat in the provincial radius and less than 500 acres in the 0.7 mile radius with an occupancy ranking of "2" and a history ranking of "1" should be considered **twelfth**.

m) Sites with occupancy and history rankings of "1" should be considered **last**.

4. Projects meeting criteria **a,** which is removing or modifying suitable spotted owl habitat outside of known provincial territories should be considered first.

5. Owl territories meeting criteria **b** through **g** were grouped and given a ranking of **one**.

6. Owl territories meeting criteria **h** through **j** were grouped and given a ranking of **two**.

7. Owl territories meeting criteria **k** through **m** were grouped and given a ranking of **three**.

8. The following conditions apply to the individual rankings.

When it is not possible to avoid modifying or removing suitable habitat within a known territory, then sites with "go to" rank of "one" should be first, "two" should be second, and "three" should be last. The rank (Table 26) for any given owl site number gives a different purpose based on Land Use Allocation (LSR or Matrix). For example, a site with a final rank of "1" in Matrix should be considered as a potential area where harvest may occur first. Details of timing, location, and distance from core area would be determined by an ID Team and other staff evaluations.

Sites with a rank of "1" in the LSR portion of the WAU should be considered first for habitat evaluation. Details of timing, location, distance from core area, objectives, and treatment prescription would be determined by the ID Team or other staff evaluations.

B. Habitat Evaluation

The concept of habitat evaluation would be applied to the landscape while maintaining objectives for the various Land Use Allocations. Habitat evaluation would describe the timing, location, and spatial distribution of habitat removal or modification on Matrix lands in the WAU. Habitat evaluation may include topics like connectivity of mature and late-successional blocks to other similar blocks and their relationship to topography, the amount suitable habitat present around spotted owl sites, where the suitable habitat is located, the connectivity of suitable habitat, and the status of dispersal habitat. The function and objectives of critical habitat should be considered in areas where Critical Habitat Units overlap Matrix lands.

In the LSR portion of the WAU, the habitat evaluation would consider current forest age classes, future age classes, location, and connection to similar habitat within or between spotted owl territories across the landscape. This evaluation could locate LSR project areas and actions where manipulation of forest stands could aid reaching old-growth characteristics sooner than if left in the current condition.

Evaluation of the connectivity of suitable habitat would be done with the aid of a photo of the Cow Creek WAU, seral age class maps, and ground inspection. This way the connection of late-successional blocks and the relationship to topography could be examined. Topography is important because knowing where connectivity is present or lacking and the relationship to riparian systems or uplands may make a difference on its success. Because of the checkerboard ownership, connectivity of the remaining older forest stands is very important. Even avian species capable of flight require connectivity of habitat for moving from one place to another. The ability to move within the forest from one place to another becomes more important to species that require or have dependency on older age classes, have small territories and move by crawling or walking across the ground.

The following is an example of steps to evaluate forest connectivity on the landscape. This example deals with owls but the process can be used for other species. This process should involve wildlife biologists, planning, and silviculture specialists.

1. Use the ranking system given before. Keep in mind habitat acre thresholds of maintaining 500 acres within 0.7 miles, 1,335 acres within 1.3 miles, or 1,286 acres within 1.2 miles of a spotted owl activity center and LSR objectives. This data was presented in Tables 24 and 25 in this watershed analysis.

3. Owl sites would be evaluated using the spatial arrangement of seral age classes within the provincial radii (1.2 or 1.3 miles) around an owl site. In the LSR, the purpose would be to locate suitable forest age classes, next to suitable habitat, where stand development toward late successional characteristics could

be accelerated. On Matrix lands, the purpose would be to locate areas where manipulation may provide a functional forest corridor and coordinate the timing and spacing of harvest units.

4. Within the WAU, the connectivity of suitable spotted owl habitat within an owl site to other late successional habitat in the vicinity would be evaluated. Blocks of older age class stands (80 years old and older) and how they are connected to other similar blocks would be analyzed. The following questions and comments would be reviewed and answered.

a. Does the provincial radii of owl sites contain forest stands suitable for harvest (Matrix) or manipulation (LSR/Matrix)? If the ranking table has been completed this information is already available.

b. Will manipulation of forest stands (LSR/Matrix) speed up attaining older age class characteristics to provide connectivity between owl sites and suitable spotted owl habitat?

c. Will timber harvesting of stands reduce connectivity between suitable owl habitat and adjacent habitat?

d. Will manipulation of the stand increase/decrease connectivity between suitable owl habitat and adjacent habitat, between the LSR and Matrix, between connectivity blocks?

e. Where is connectivity needed? In the upland or in the riparian area of the drainage? Both? Is the Riparian Reserve connection adequate to meet objectives?

f. Evaluate and select forest stands to leave without manipulation and likely pros and cons of such choice (in Matrix or LSR). This can lead to long-term connection across the landscape of older forest stands.

Table E-1. Special Status and Other Category Wildlife Species in the Cow Creek WAU.

SPECIES	STATUS	PRESENCE	MONITORING LEVEL
VERTEBRATES			
FISH			
Coho salmon (Oncorhynchus kisutch)	SC, AS	D	3
Umpqua chub (Oregonighthys kalawatseti)	SoC, SV, BS	S	1
Umpqua basin cutthroat trout (Oncorhynchus clarki clarki)	FE	D	3
Pacific lamprey (Lampetra ayresi)	SoC, BS	D	3
Steelhead trout (Oncorhynchus mykiss)	FP	D	3
AMPHIBIANS AND REPTILES			
Clouded salamander (Aneides ferrous)	SU, AS	D	3
Del Norte salamander (Plethodon elongatus)	S&M, SoC, SV, BS	D	3
Foothill yellow-legged frog (Rana boylii)	SoC, SV, BS	D	3
Northern Red-legged frog (Rana aurora aurora)	SoC, SU, BS	D	3
Southern Torrent salamander (Rhyacotriton variegatus)	SoC, SC, BS	D	3
Tailed frog (Ascaphus truis)	SoC, SV, BS	U	3
Western toad (Bufo boreas)	SV, BT	S	1
California Mountain kingsnake (Lampropeltis zonata)	SV, AS	S	1
Common kingsnake (Lampropeltis getulus)	SV, AS	S	1
Northwestern pond turtle (Clemmys marmorata marmorata)	SoC, SC, BS	D	3
Sharptail snake (Contia tenuis)	SV, AS	D	3
BIRDS			
Harlequin duck (Histrionicus histrionicus)	SoC, BS	U	1
Marbled murrelet (Brachyramphus marmoratus marmoratus)	FT, ST, CH	S	3
Bald eagle (Haliaeetus leucocephalus)	FT, ST	S	1
Northern goshawk (Accipiter gentilis)	SoC, SC, BS	S	3
Peregrine falcon (Falco peregrinus anatum)	FE, ST	D	4
Great gray owl (Strix nebulosa)	S&M, SV, AS	U	1
Northern spotted owl (Strix occidentalis caurina)	FT, ST, CH	D	4
Flammulated owl (Otus flammeolus)	SC, AS	U	1
Pygmy owl (Glaucidium gnoma)	SU	D	3
Northern Saw-whet Owl (Aegolius acadicus)	AS	S	1
Acorn Woodpecker (Melanerpes formicivorous)	SU	U	1

Table E-1. Special Status and Other Category Wildlife Species in the Cow Creek WAU.

SPECIES	STATUS	PRESENCE	MONITORING LEVEL
Lewis' woodpecker (Melanerpes lewis)	SC, AS	U	1
Pileated woodpecker (Dryocopus pileatus)	SV, AS	D	3
Little willow flycatcher (Empidonax traillii brewsteri)	SoC, BS	S	1
Purple martin (Progne subis)	SC, AS	D	3
Pygmy nuthatch (Sitta pygmae)	SV	U	1
Western bluebird (Sialia mexicana)	SV, AS	S	3
Oregon vesper sparrow (Pooecetes gramineus)	SC, BT	U	1
MAMMALS			
Fringed myotis (Myotis thysanodes)	SoC, SV, BS, S&M	D	3
Long-eared Myotis (Myotis evotis)	SoC, BS, S&M	D	3
Long-legged Myotis (Myotis volans)	SoC, BS, S&M	D	3
Pacific pallid bat (Antrozous pallidus)	S&M, SC, AS	D	3
Silver Haired Bat (Lasionycteris noctivagans)	BT	D	3
Townsend's big-eared bat (Corynorhinus townsendii)	SoC, SC, BS	D	3
Yuma Myotis (Myotis yumanensis)	SoC, BS	D	3
Ringtail (Bassariscus astutus)	SU	S	1
American marten (Martes americana)	SC, AS	U	1
Pacific Fisher (Martes pennanti pacifica)	SoC, SC, BS	U	1
California wolverine (Gulo gulo luteus)	SoC, BS	U	1
North American Lynx (Felis lynx canadensis)	S&M	U	1
White-footed vole (Arborimus albipes)	SoC, BS, SP	S	1
Red Tree Vole (Arborimus longicaudus)	S&M	D	3
INVERTEBRATES			
Blue-gray taildropper (Prophysaon coeruleum)	S&M	D	3
Oregon shoulderband (Helminthoglypta hertleini)	S&M	S	3
Oregon megomphix (Megomphix hemphilli)	S&M	S	3
Papillose taildropper (Prophysaon dubium)	S&M	S	3
Alsea ochrotichian micro caddisfly (Ochrotrichia alsea)	SoC, BS	U	1
Denning's agapetus caddisfly (Agapetus denningi)	SoC, BS	U	1
Vertree's ochrotichian micro caddisfly (Ochrotrichia vertreesi)	SoC, BS	U	1
Franklin's bumblebee (Bombus franklini)	SoC, BS	U	1

STATUS ABBREVIATIONS:	**PRESENCE ABBREVIATIONS**:
FE -- Federal Endangered	**D** -- Documented by surveys or identified in the field
FT -- Federal Threatened	**S** -- Suspected, habitat present
FP -- Federal Proposed	**U** -- Uncertain
FC -- Federal Candidate	
SoC-- Federal species of concern	August 14, 1997 RHEspinosa
CH -- Critical habitat designated	**MONITORING LEVELS USED TO DOCUMENT SPECIES:**
SE -- State Endangered	**N** -- No surveys done or planned
ST -- State Threatened	**1** -- Literature search only
SC -- ODFW Critical	**2** -- One field search done
SV -- ODFW Vulnerable	**3** -- Some surveys completed
SP -- ODFW Peripheral/Naturally Rare	**4** -- Protocol completed
SU -- ODFW Undetermined	
BS -- Bureau Sensitive Species (BLM)-This status reflects interim status for former USFWS FC1 and FC2 species as per instruction communication from Oregon state office (March 7,1996) and IM-OR-97-118 (April 30,1997).	
AS -- Bureau Assessment Species (BLM)	
BT -- Bureau Tracking species (BLM)	
S&M--Survey and Manage (ROD)	

Appendix F

Plants

Appendix F

Table F-1. Survey and Manage Plant Species Suspected to Occur in the Cow Creek WAU.

Species	Survey Strategy			
	1	2	3	4
Vascular plants				
Allotropa virgata	X	X		
Aster vialis	X	X		
Bensoniella oregana	X	X		
Cypripedium fasciculata	X	X		
Cypripedium montanum	X	X		
Fungi				
Rare False Truffles				
Gautieria otthii	X		X	
False Truffles				
Rhizopogon truncatus			X	
Chanterelles				
Cantharellus cibarius			X	X
Cantharellus subalbidus			X	X
Cantharellus tubaeformis			X	X
Chanterelles-Gomphus				
Gomphus clavatus			X	
Gomphus floccosus			X	
Gomphus kauffmanii			X	
Tooth Fungi				
Hydnum repandum			X	
Hydnum umbilicatum			X	
Rare Resupinates and Polypores				
Gyromitra esculenta			X	X

Appendix F

Table F-1. Survey and Manage Plant Species Suspected to Occur in the Cow Creek WAU.

Species	Survey Strategy			
	1	2	3	4
Gyromitra infula			X	X
Otidea leporina			X	
Otidea onatica			X	
Otidea smithii	X		X	
Sarcosoma mexicana			X	
Sarcosphaera eximia			X	
Rare Cup Fungi				
Aleuria rhenana	X		X	
Helvella elastica	X		X	
Helvella maculata	X		X	
Lichens				
Rare Leafy Lichens				
Hypogymnia duplicata	X	X	X	
Rare Nitrogen-Fixing Lichens				
Lobaria hallii	X		X	
Nephroma occultum	X		X	
Pseudocyphellaria rainierensis	X	X	X	
Riparian Lichens				
Usnea longissima				X
Nitrogen-fixing Lichens				X
Lobaria oregana				X
Lobaria pulmonaria				X
Lobaria scrobiculata				X
Pseudocyphellaria anomala				X

Appendix F

Table F-1. Survey and Manage Plant Species Suspected to Occur in the Cow Creek WAU.

Species	Survey Strategy			
	1	**2**	**3**	**4**
Pseudocyphellaria anthraspis				X
Pseudocyphellaria crocata				X
Sticta limbata				X
Nephroma resupinatum				X
Rare Oceanic Influenced Lichens				
Usnea hesperina	X		X	
Oceanic Influenced Lichens				
Loxospora sp nov. "corallifera"	X		X	
Bryophytes				
Antitrichia curtipendula (Moss)				X
Plagiochila satoi (Moss)	X		X	
Ptilidium californicum (Liverwort)	X	X		
Racomitrium aquaticum (Moss)	X		X	

Survey Strategies:
1= Manage Known Sites
2= Conduct Surveys Prior to Activities and Manage Sites
3= Conduct Extensive Surveys and Manage Sites
4= Conduct General Regional Surveys